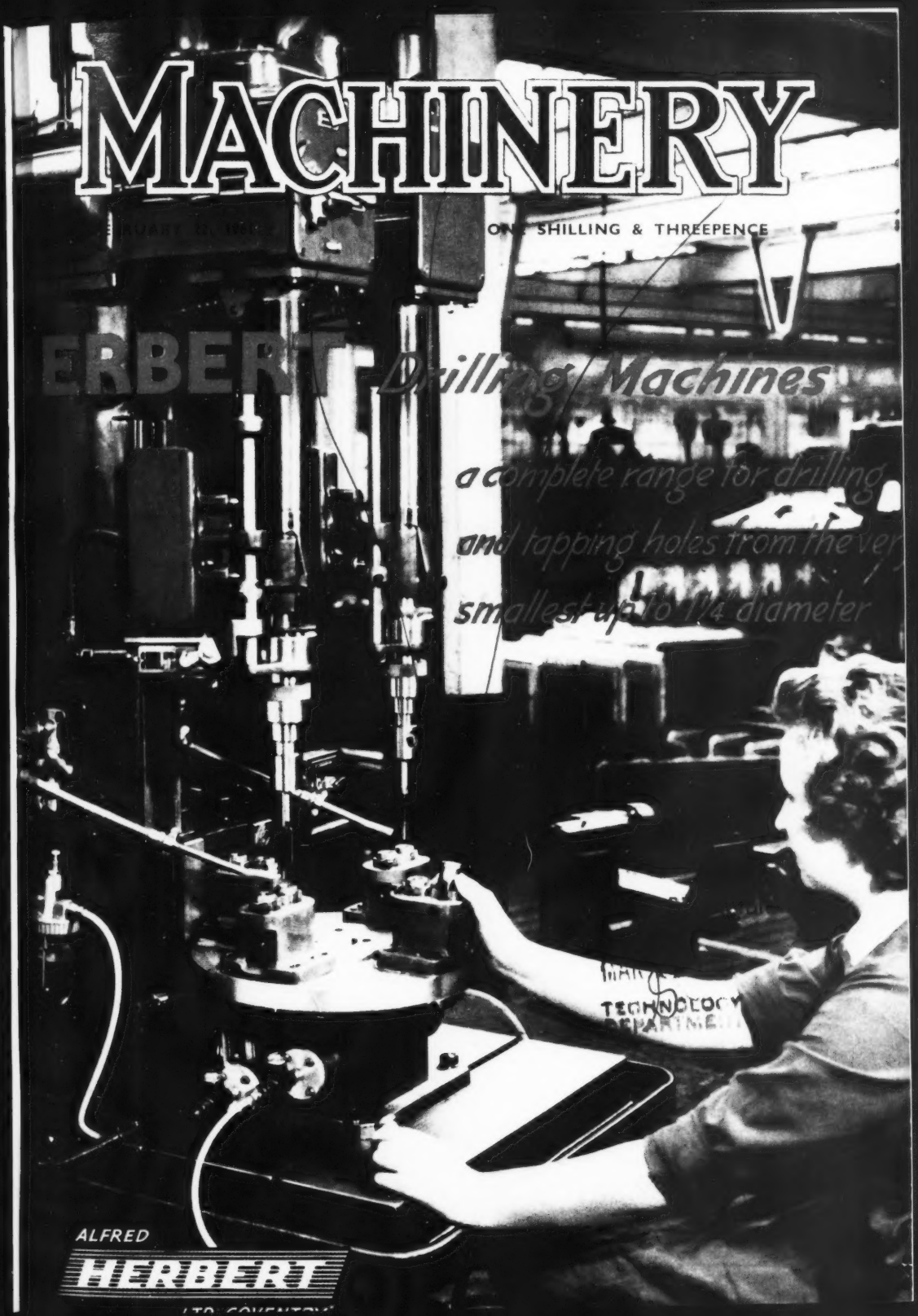
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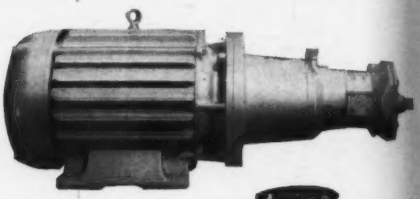
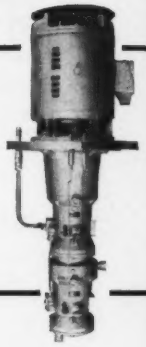
1

This is a Towler axial plunger oil pump, size A4, which discharges 18·6 cu.ins./sec. up to 5,500 p.s.i. at 1,440 r.p.m. It can be supplied motorised as shown.



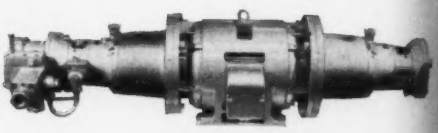
2

Two axial pumps can be mounted in tandem, one driven through the other. This example shows a motorised size A4TA4 pump fitted to a tank mounting flange, ready to drop into a tank (which is supplied if required).



3

A vane pump (L series) is available built on to the axial pump. In this example the vane pump is fitted with a relief and unloading valve. From right to left, the combination shown here is A1CL-motor-A4L96. Vane pump discharges up to 1,000 p.s.i. are 21, 34, 61, 96 cu. ins./sec. at 1,500 r.p.m.



4

Towler axial pumps are available with discharges (series A) up to 18.6 cu.ins./sec. at 5,500 p.s.i. at 1,440 r.p.m. or (series XA) 12.4 cu.ins./sec. at 9,000 p.s.i. at 1,440 r.p.m. They are also available for face and foot mounting, packaged in or on a tank; there is full range of valves, and an excellent high pressure system design service is available.

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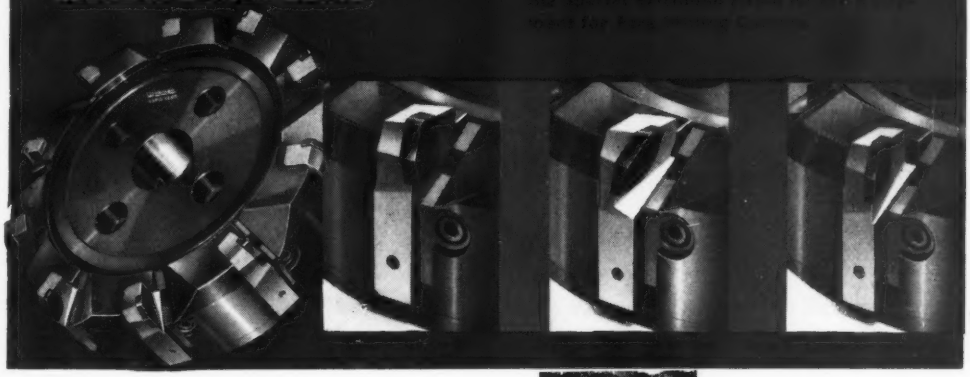

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The use of the Wickman Rapid Re-set Cutter Body and three blade styles available provides a simple variation of blade geometry. The blades can be removed, re-ground, checked and replaced in any Cutter Body size within the range—WITHOUT REMOVING THE CUTTER BODY FROM THE MACHINE, thus reducing down times and costs to a minimum.

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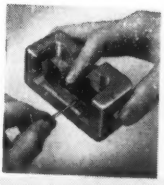

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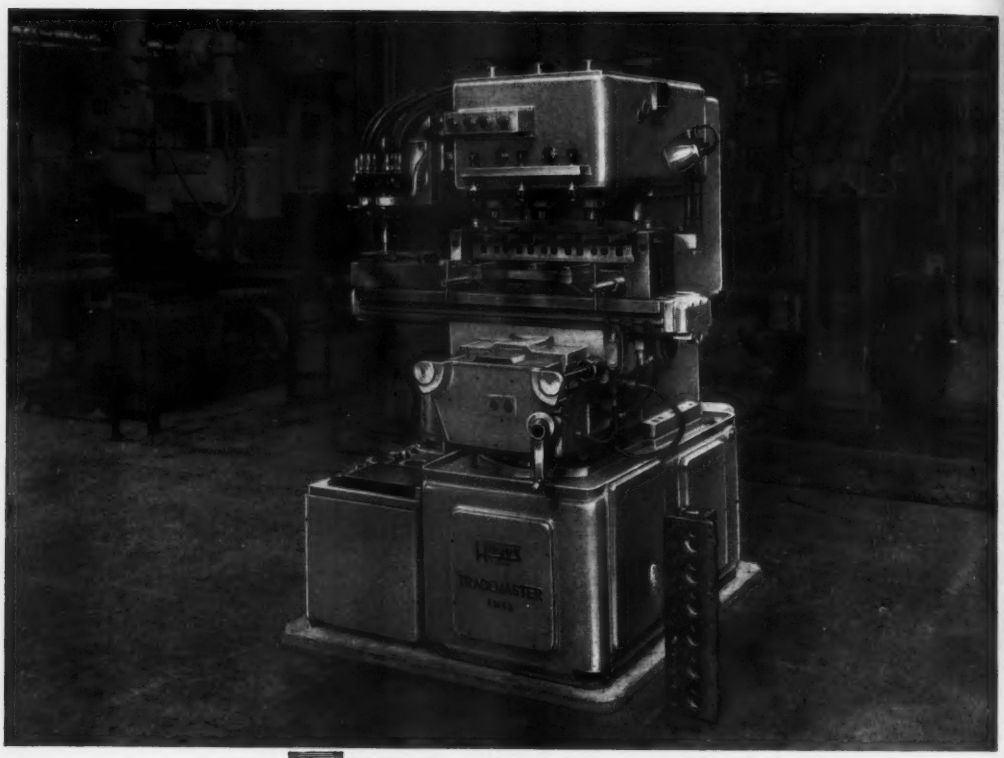

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According to modern atomic theory, at extremely high pressure atoms can become crushed and matter can collapse in upon itself. Even the entire Earth is far too light to achieve this pressure but at the centre of Jupiter, which is 317 times heavier than the Earth, this pressure is almost reached. If Jupiter was any bigger the matter at its centre would literally buckle and the planet would contract. For this reason when you see Jupiter you can fairly claim to be looking at the 'largest stone in the Universe.'

Yet even Jupiter is part of man's eventual heritage and we, at Balfours, are preparing the basic means of Production, the High Speed Steel and Alloy Tool Steels, Reamers, Cutters, Twist Drills and other Engineers Tools that will one day make it possible for space vehicles to travel to these remote regions.

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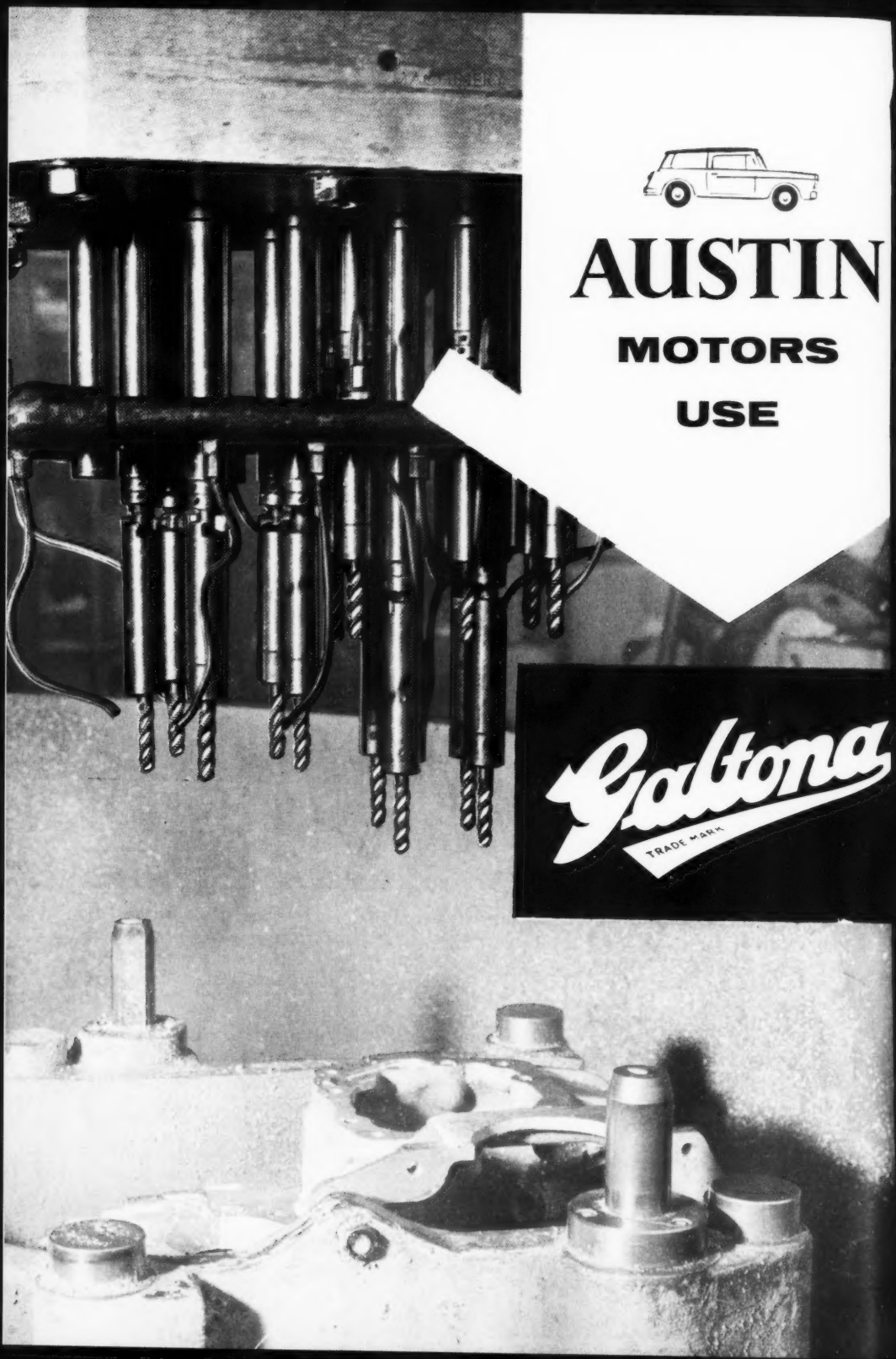
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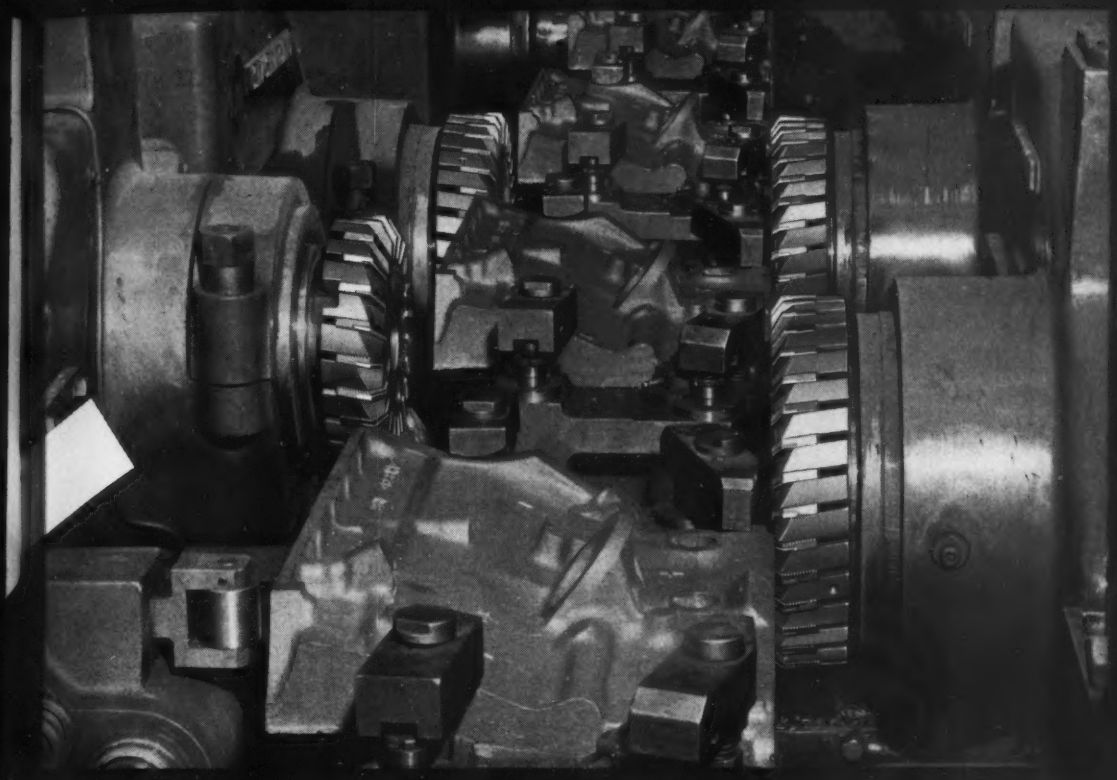

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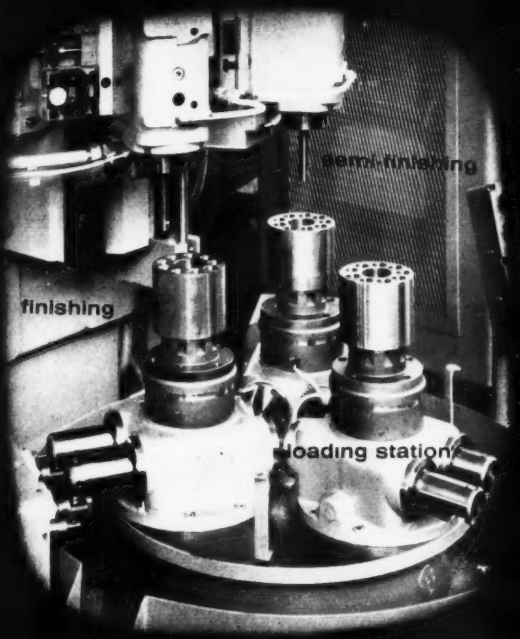

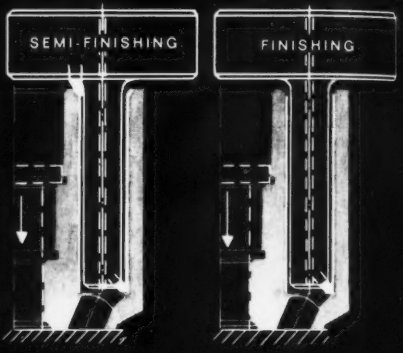

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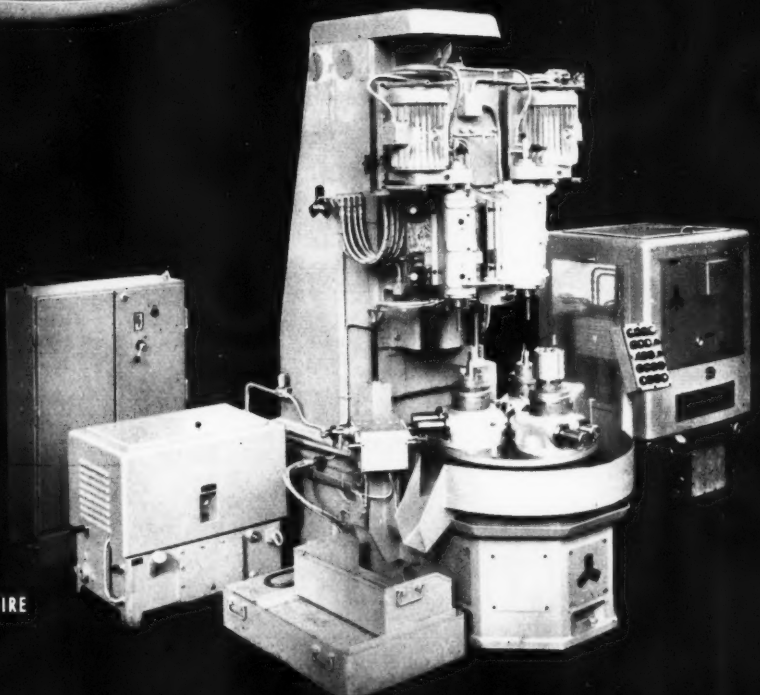

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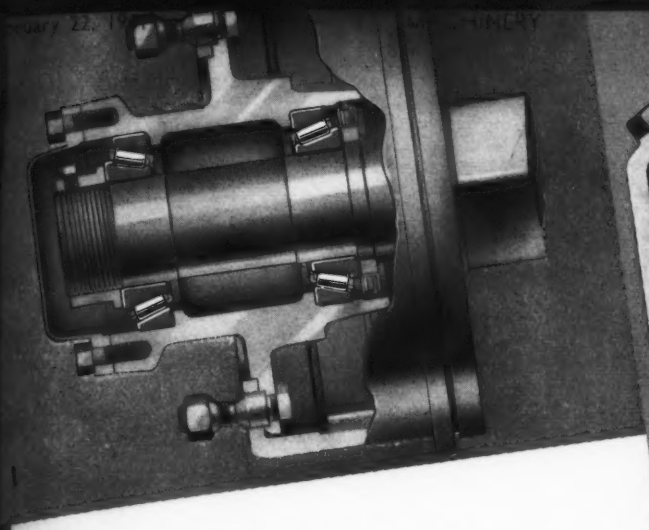

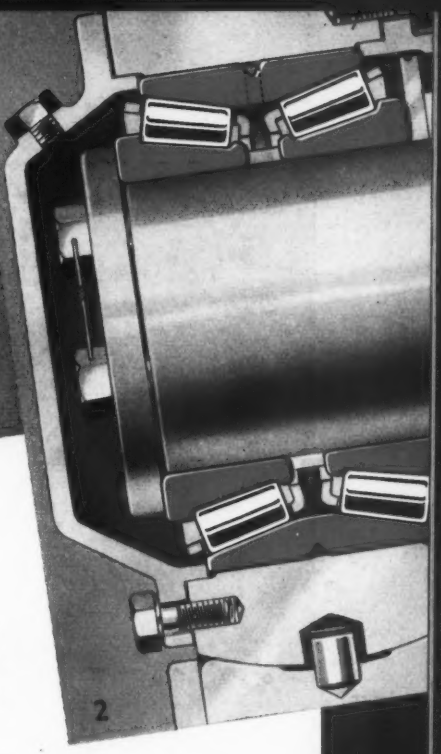

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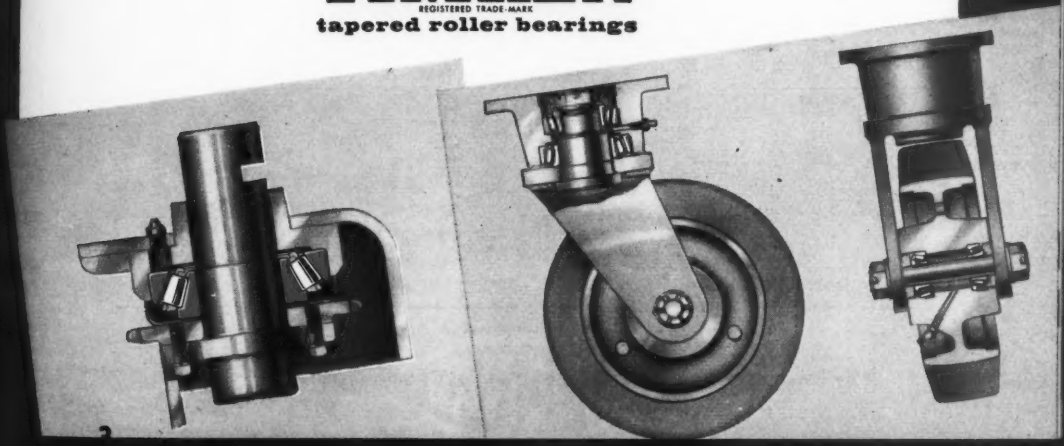

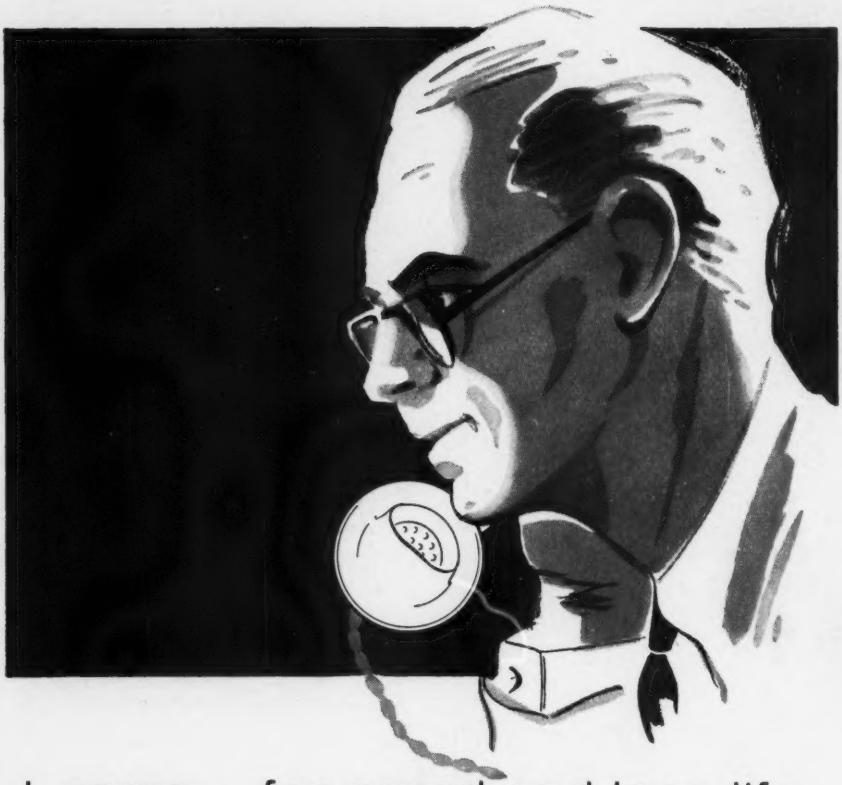

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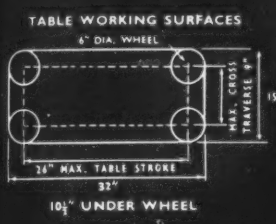

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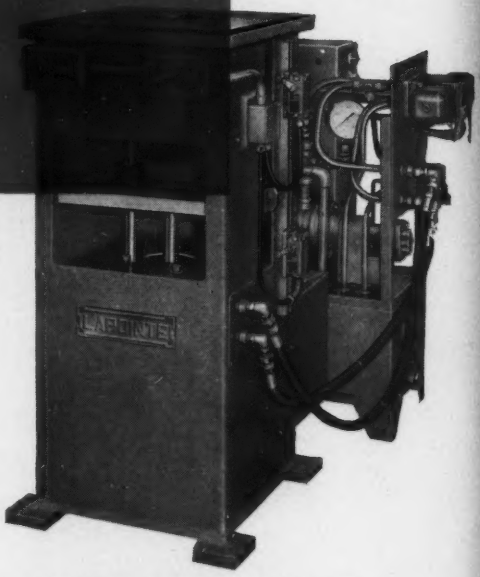

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Stroke: 16 in.
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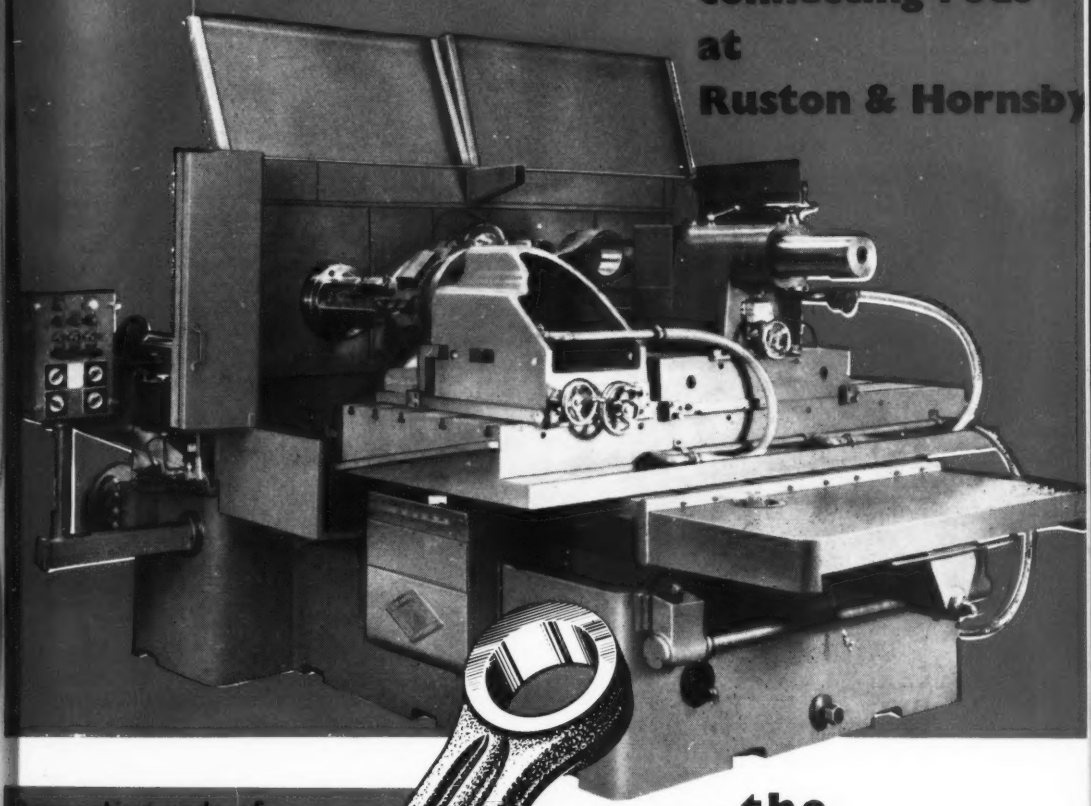
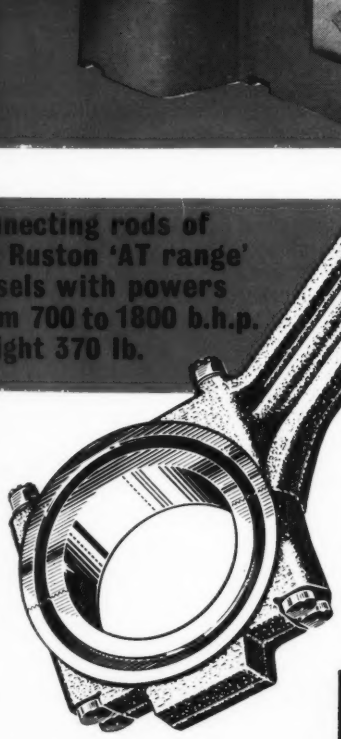
connecting rods at Ruston & Hornsby



Connecting rods of the Ruston 'AT range' diesels with powers from 700 to 1800 b.h.p. Weight 370 lb.



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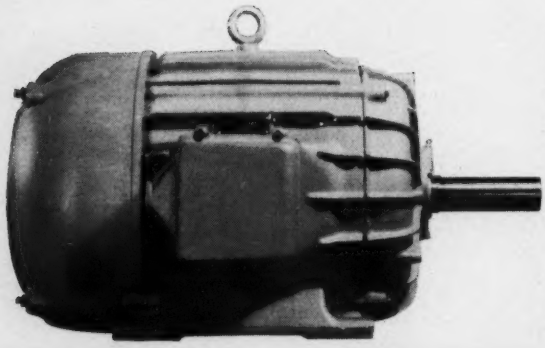
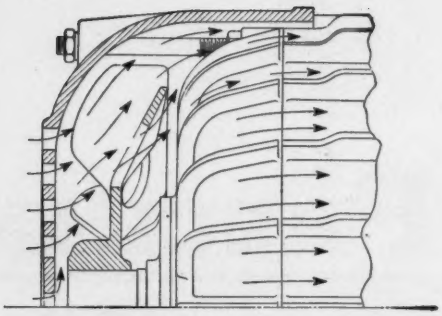


Engineers use the word performance in two senses, a limited one which refers to parameters that can be specified and checked, and a wider, vaguer, but essentially more realistic sense which covers reliability, freedom from trouble, ease of servicing, ready adaptability and many other things. Performance in the first sense is reproducable by any competent manufacturer; it depends on designing to well established principles. Performance in the second sense is the basis of choice between manufacturers. It comes from countless small differences in design that are based on...

This thing called know-how



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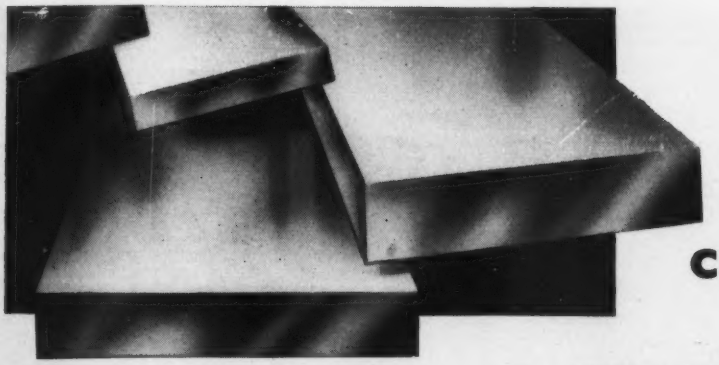

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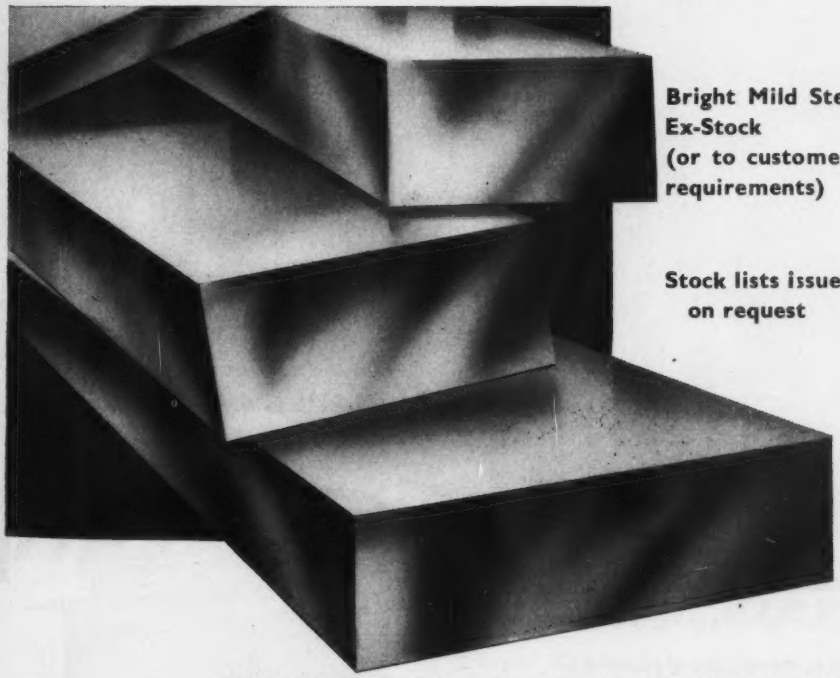

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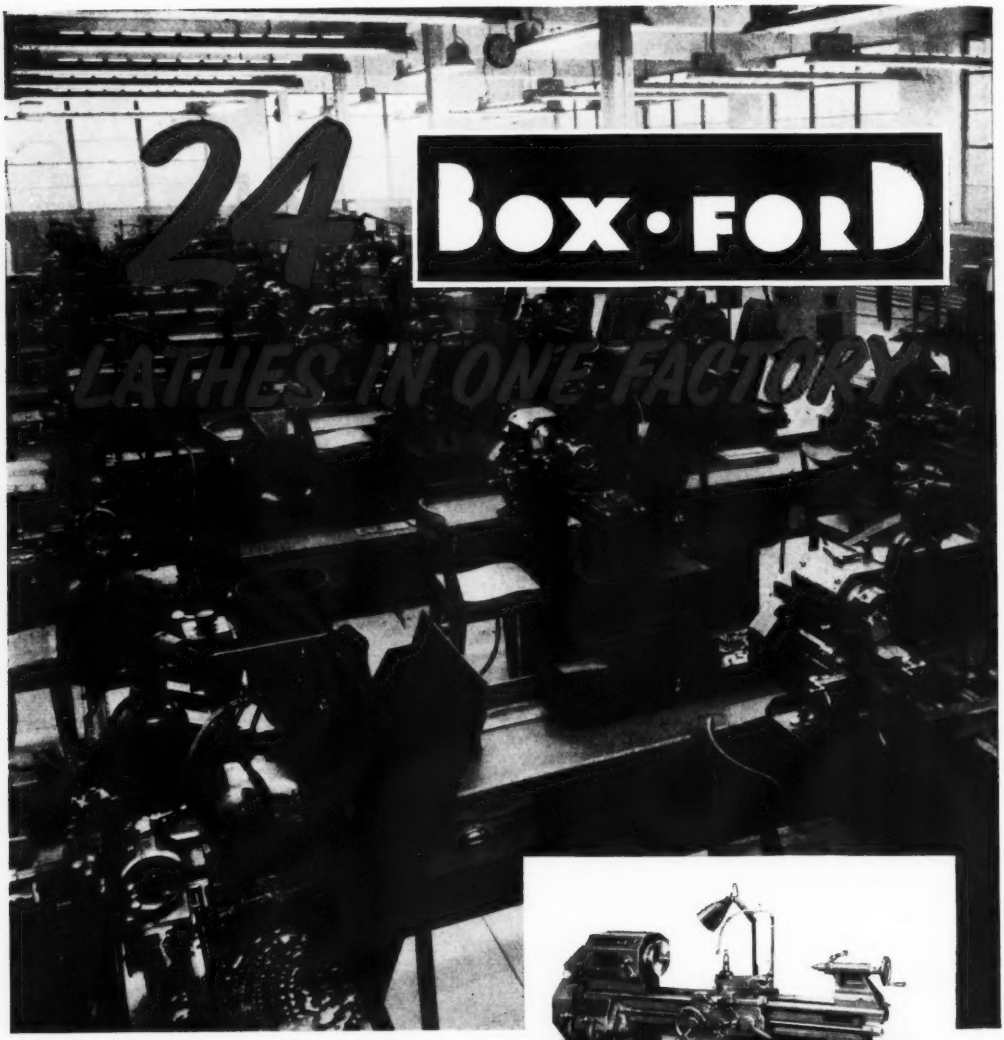

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Model AUD with Norton type gearbox and automatic apron—one of the latest BOXFORD lathes.

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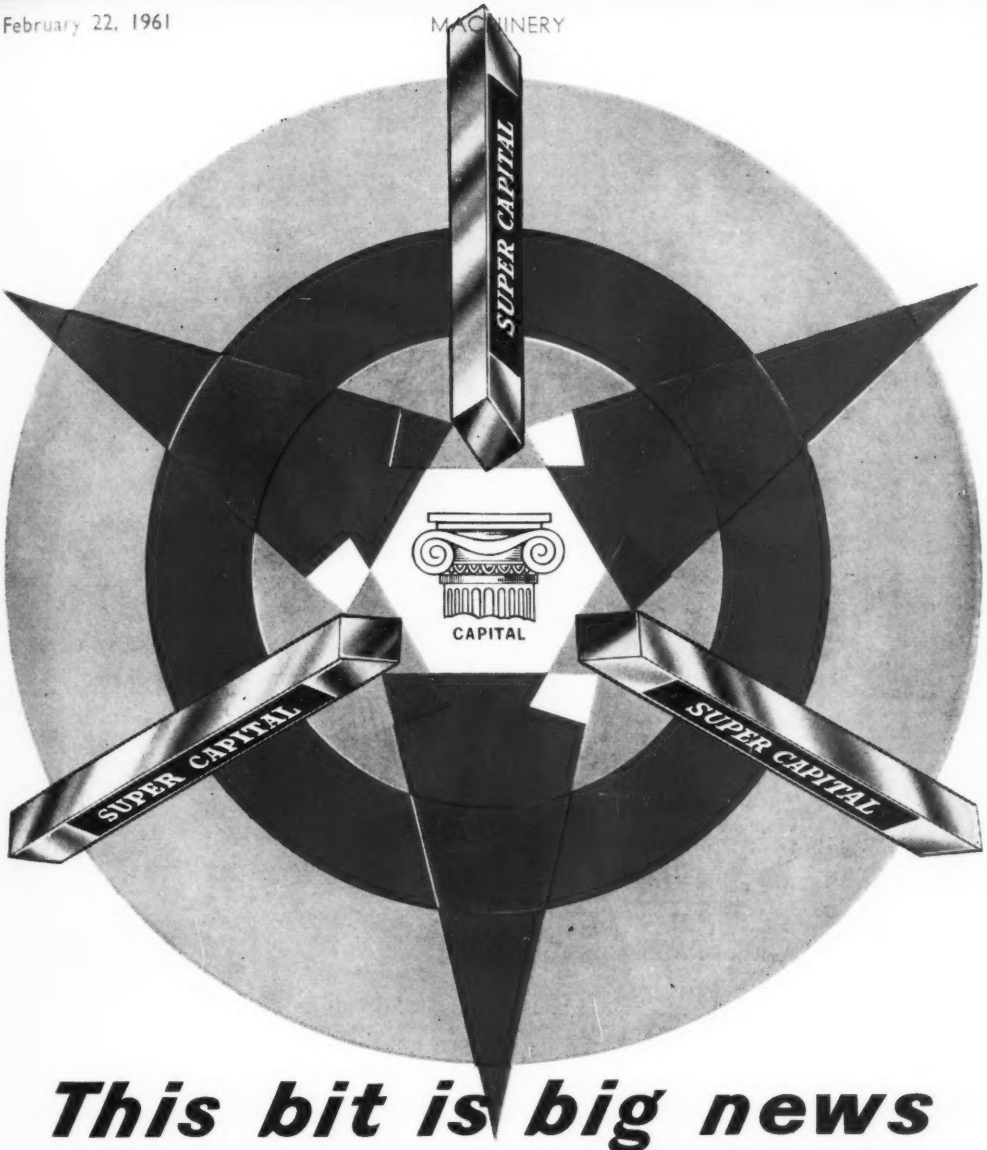

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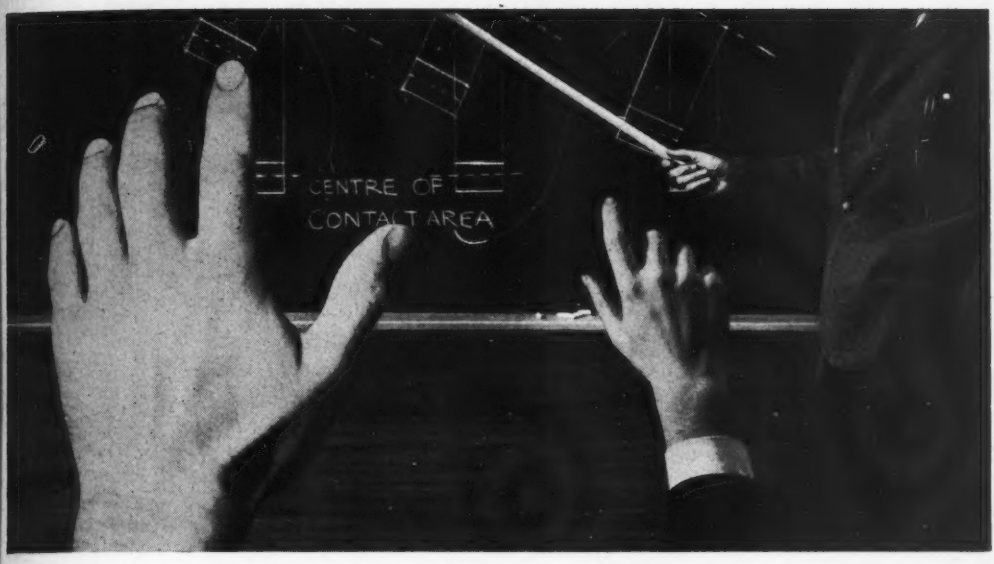

There's talk of Sykes in the Technical Colleges...

As the development of production engineering depends on the men it takes and the way it trains them, the machine tool industry is paying ever-growing attention to the subject of recruits and trainees.

The number of specialised courses for machine tool technicians grows steadily. Training facilities for students at all levels are available in technical colleges, evening classes and universities.

And Sykes, with their vast knowledge and experience of gear production, are helping in a practical way to foster the study of gear design and to spread knowledge of the latest techniques in gear cutting and finishing.

To selected technical schools Sykes have presented demonstration models of double-helical gear trains, and, in engineering laboratories and college workshops there are Sykes machines—each installed by Sykes engineers who give detailed instruction in their operation and application.

Hobs, cutters and other small tools are supplied for lectures and demonstrations . . . film strips, with lecture notes, may be had on loan . . . and there are brochures, instruction manuals, photographs and data on interesting techniques freely available to teaching authorities.

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Talk to SYKES about gear production

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Are YOU using welded tube economy?

Today in countless uses welded stainless steel tube is specified in preference to solid seamless tube. It is also considerably cheaper. That's why more and more progressive industries are using PERMBRITE tube. They know that, with today's enormous progress in welding techniques, this tube is not only equal to 'solid seamless' in strength—but is generally more consistent and uniform in wall thickness, with no inclusions. Are *you* up-to-date with welded tube economy?

STRENGTH

Exhaustive tests and extensive use have proved the 'weld is as strong as the wall'—and as resistant to corrosion.

VERSATILITY

Welded tube can be used for heat exchangers, corrosive plant, high pressure uses, chemical piping—all those exacting uses which once demanded 'solid seamless.'

UNIFORMITY

Because the tube is made from precision steel strip—you can depend on a uniform thickness of wall in welded tube.

HIGH PRESSURES

Welded tube can withstand working pressures of from 1,000 to 5,000 p.s.i. depending on size.

SPEED OF DELIVERY

Your needs in welded tube can be met from stock in many cases, or made to order quickly.

Permbrite welded stainless steel tubes are made in a range from ¼ in. o.d. to 2½ in. o.d. in wall thicknesses 26G to 12G. These tubes are made from austenitic stainless steel to international specifications.

USED.

Permbrite

STAINLESS STEEL TUBING

Write for details to:-

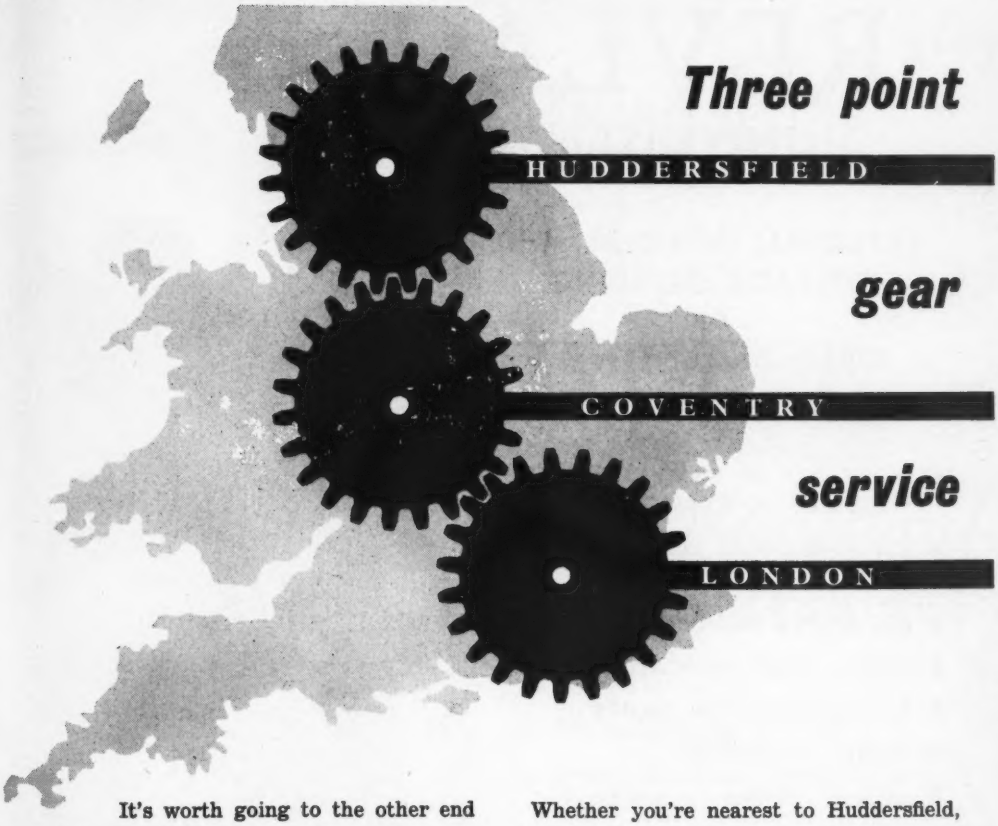
Rollo-Hardy & Co Ltd

Sales and Administration:
Paddockhall Rd, Haywards Heath, Sussex
Tel: Haywards Heath 1831 (5 lines)

FACTORY: BLAERNHONDDA, GLAM

(A member of the Compoflex group of Companies)

YSA 6310/1



It's worth going to the other end of the country — to the other end of the world! — for David Brown gears. But happily you don't have to. In addition to their headquarters in Huddersfield, David Brown have factories in Coventry and London. Each of these Divisions offers a first class service in gear production. Whether you're nearest to Huddersfield, Coventry or London you get the benefit of the immense resources of the whole David Brown organization. If you're not already a D.B. customer, get in touch with your nearest factory right away — and learn for yourself what they can do!

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100 YEARS 1860-1960

THE DAVID BROWN CORPORATION (SALES) LIMITED

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THE REVLAC

UNIVERSAL TRIGRINDING MACHINE

MODEL No. 810

EXTERNAL, INTERNAL AND SURFACE GRINDING ON ONE MACHINE! TO MICRO-INCH FINISHES

- WORK SIZE UP TO 8in. DIA. AND SPEEDS UP TO 43,000 R.P.M.
- REVERSIBLE AND DOUBLE ENDED HEADSTOCK
- ALL SPEEDS INFINITELY VARIABLE
- VISUAL SPEED INDICATORS
- ANGLE INDICATOR GAUGE
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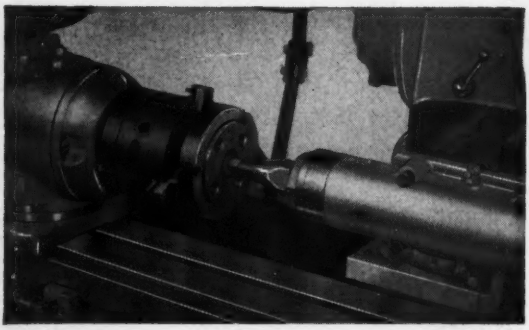
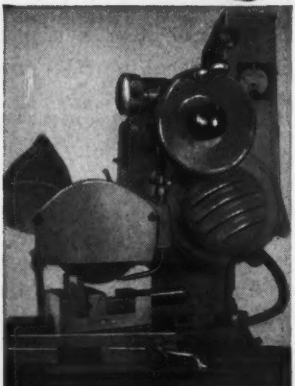
- ·00005in. INFEED



The machine can be rapidly adapted for internal grinding as shown.



Toolroom or production surface grinding can easily be carried out to precise limits.

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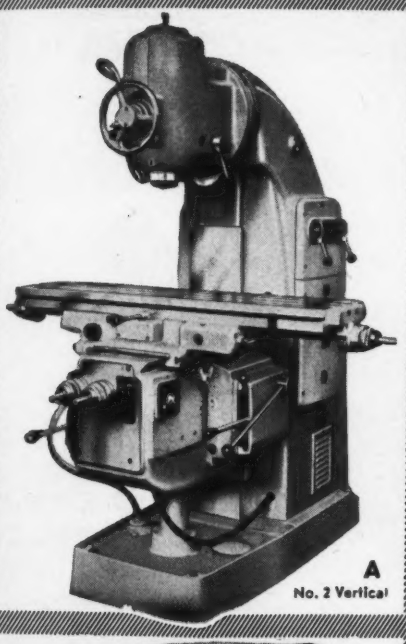
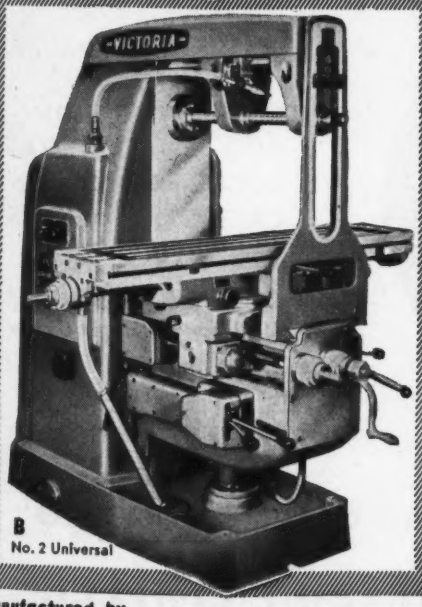


A
No. 2 Vertical



B
No. 2 Universal

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VICTORIA

Rapidmil

MILLING MACHINES

- ★ 48" x 11¼" Table
- ★ 32" Longitudinal Traverse
- ★ Power Feeds and Rapid Traverse in all directions
- ★ 12 Spindle Speeds 30-1050 r.p.m.
- ★ 18 Table Feeds 0.65-15 in./min.
- ★ 5 h.p. motor
- ★ Backlash Eliminator Standard Equipment

PRICES

A £1830 Including 3-phase electrics

B £1650 Including 3-phase electrics

Manufactured by

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SHARDLOW MICROMETERS

WITH A NEW OBLIQUE LINE SLEEVE TO ELIMINATE ·025" (·5 mm) LINE READING ERRORS

THIS SLEEVE CAN BE PROVIDED ON EXTERNAL AND INTERNAL MICROMETERS OF 1" (25 mm.) CAPACITY.

WHEN ORDERING ADD X TO CATALOGUE NO. TO INDICATE NEW SLEEVE IS REQUIRED.

Write for Catalogue of Micrometers & Height Gauges

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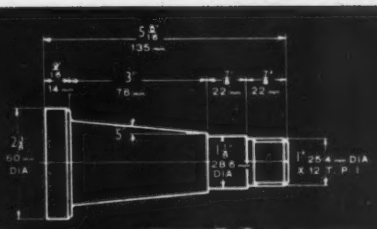
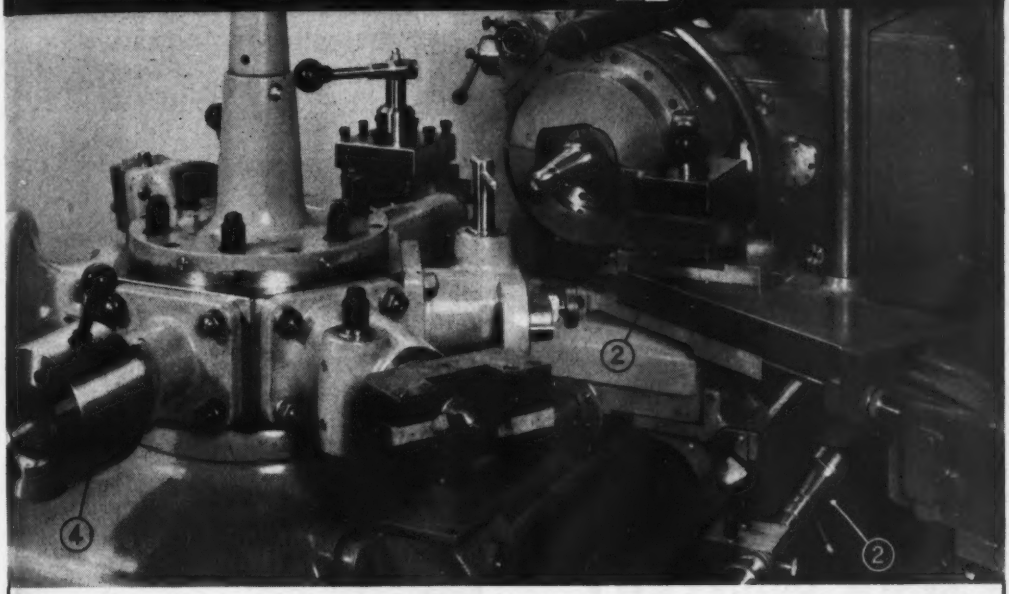
Ward SPECIAL

TOOLING LAYOUT No. 16





AXLE SHAFT

2½" dia. 25 ton Tensile Steel E.N.I.A.
Tungsten Carbide Cutting Tools.

No. 7 PRELECTOR TURRET LATHE

Code Word : **Covetable**

Fitted with 2½" Air Bar Chuck and Hydraulic Copy Turning Attachment.

Floor to Floor Time :
4 mins. 20 secs.

DESCRIPTION OF OPERATION	Tool Position		Spindle Speed R.P.M.	Max. Cutting Speed		Feed	
	Hex. Turret	Cross-slide		Feet per min.	Metres per min.	Cuts per inch	m/m. per rev.
1. Feed bar to stop, close chuck & centre drill	1	—	1000	—	—	Hand	Hand
2. Support end of bar with live centre	2	—	—	—	—	—	—
Copy turn 1st. cut $\frac{7}{16}$" deep × 4$\frac{3}{4}$" long	—	Rear	1000	654	200	104	·244
" " 2nd. " $\frac{1}{4}$" " × 3$\frac{3}{4}$" "	—	"	1000	392	119	104	·244
" " 3rd. " $\frac{1}{16}$" " × 5$\frac{5}{8}$" "	—	"	1000	654	200	104	·244
3. Roller end & chamfer	3	—	1000	260	79·5	Hand	Hand
4. Screw with diehead 1" dia. × 12 t.p.i.	4	—	70	18	5·5	—	—
5. Part off	—	Front	1000	654	200	Hand	Hand

'PRELECTOR' Combination Turret Lathes with Preselective speed-changing.

TURRET LATHES with capacities up to 35 in. swing over bed

1¼ in. to 2¼ in. 'D-S' DOUBLE-SLIDE' Capstan Lathes for heavier accurate work.

Stock Tools, Toolholders, Chucks and Accessories for Capstan and Turret Lathes.

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Quality Plus...

THE

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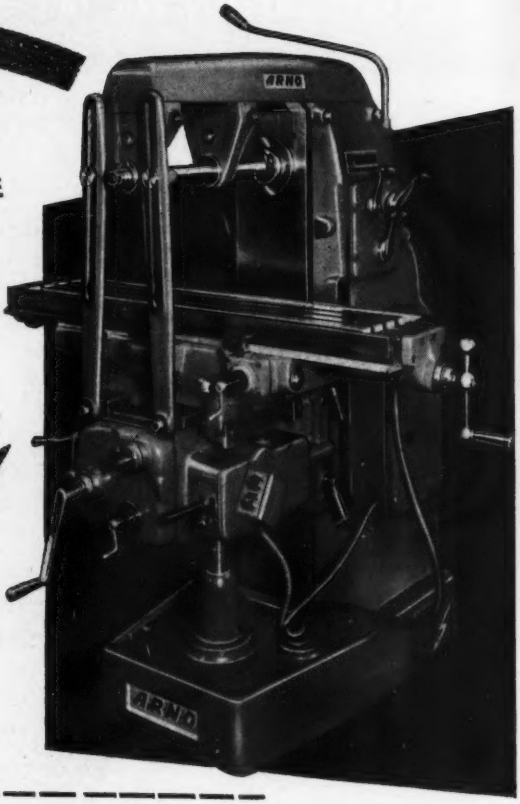
UNIVERSAL MILLING MACHINE

COMPLETE WITH

Vertical attachment and
Universal Dividing Head

—at no extra cost!



AVAILABLE FOR DELIVERY MARCH, 1961

PRICE : £1,235

SPECIFICATIONS :

TABLE
Working surface ..... 43¼" x 10"
Swivels (right or left) ..... 45°

RANGE (automatic)
Longitudinal ..... 30½"
Cross ..... 9½"
Vertical ..... 18"
Maximum distance from centreline of spindle to top of table ..... 18"

OVERARM
Distance from under-side to centreline of arbor ..... 5¼"

SPINDLE
N.S. Taper 40
Number of spindle speeds 12
r.p.m. 30-1200

ARBOR
Diameter of arbor ..... 1"

FEEDS (per minute)
Number of feeds 12
Feeds in all directions ¼" - 21¼"

ELECTRIC DRIVE
Motor for spindle drive and feeds 3HP
Coolant pump motor 0.20HP

NETT WEIGHT OF MACHINE ..... 2900 lb.

Kerry's (GREAT BRITAIN) LTD.

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Smooth, sure and silent—that's how CROFTS (US) PowerGrip Timing Belts run, with the accuracy of gears and the flexibility of V-ropes. It makes no difference if your machine speed is 6,000 feet per minute or inches per hour, you still have close to 100% efficiency. And you still have no lubrication or maintenance costs, no belt tension (and no speed loss due to belt slip) and reduced bearing loads. Stock drives are available up to 64 h.p. at 6,000 r.p.m.

Send today for your copies of Publications 161 and 359, which give full information.

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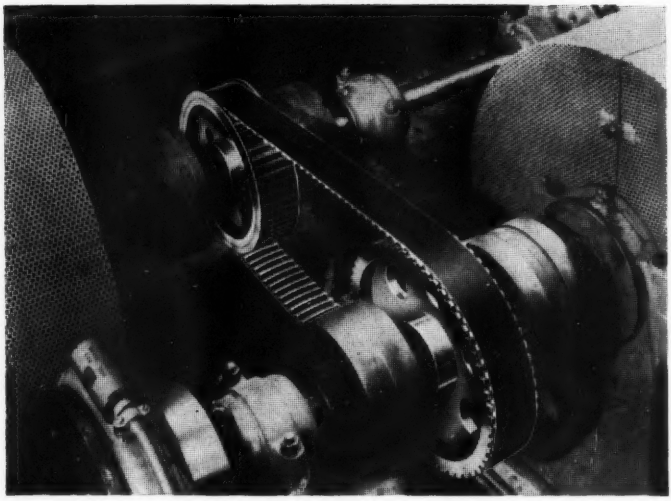

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Please send us, without obligation, ... copies of your Publications 161 and 359, dealing with Light and Heavy Duty PowerGrip Drives.

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Electrical Aids in Industry *Data Sheet* **No. 16**

Speed control of Electric Motors

'Variable' speed may involve two or three (or more) speed steps or infinitely variable (stepless) speed control. It is this latter type which is considered below. Of the many advantages of electric drives, the opportunity offered for infinitely variable speed control is outstanding. Unfortunately this advantage is not used as much as it might be.

Principal Factors Affecting Choice of Drive

(a) First cost, (b) Efficiency, (c) Speed range, (d) Regulation, (e) Power-to-weight ratio, (f) Availability of supply, (g) Maintenance and reliability, (h) Change in power and torque over the speed range, (i) Simplicity of control gear, (j) Effect of variation in supply, (k) Power factor, (l) Characteristics of the load, (m) Operational environment, (n) Braking requirements.

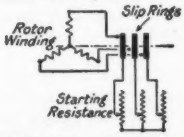
The following are some methods of obtaining infinitely variable speeds:

Alternating Current Motors

The vast majority of electric drives employ A.C. motors. Although not quite so flexible as D.C. motors, there are available many types which give a large measure of speed variation.

INDUCTION MOTORS. Although the squirrel-cage motor is essentially a constant-speed machine, it is much used for stepless variable-speed drives with one of the following types: (a) Eddy-current coupling, (b) Ferromagnetic particle coupling, (c) Mechanical drives, e.g., belt drives and friction drives, (d) Hydraulic variable-speed drives.

SLIP-RING MOTORS. The slip-ring motor, which costs more than the squirrel-cage motor, can be varied in speed by



means of the resistors in the rotor circuit used for starting. The amount of resistance in circuit can be varied by hand, push-button or automatically controlled contactors.

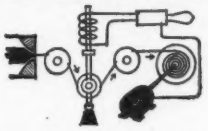
A.C. COMMUTATOR MOTORS. These are three-phase induction motors provided with additional windings which, through a commutator and brushes, permit speed adjustment in either direction below and above synchronous speed. The brush gear can be automatically controlled in such a way as to vary the speed in accordance with a known programme or cycle of operation.

Ward-Leonard System

In this system the armature of a D.C. motor is supplied at variable voltage from a separate generator. The generator may be driven by an A.C. or D.C. motor directly coupled to it and to an exciter which supplies the field windings of the generator and main motor. By means of a potentiometer resistance, the generator voltage may be varied from maximum to zero.

Electronic Motor Control

The speed of motors can be controlled accurately by electronic methods. Such drives can respond in any desired manner to variations, and several drives



can be interlocked so that their speeds are always in the same ratio. The system can be speeded up or slowed down from a 'master' controller, but for 'running in' purposes the speed of each drive can be individually regulated. Electronic speed control has been successfully applied where human control is not possible, e.g., in register control. In this example, print must always be placed at exact position on packaging material.

Direct Current Motors

The striking advantages of D.C. motors sometimes make it worth while installing a motor-generator set, a mercury-arc or semi-conductor rectifier. The speed of D.C. motors is easily controlled by inserting a resistance in series with the motor. Although this can result in a certain amount of wasted electricity, the benefits derived will often heavily outweigh such losses.

For further information get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London, W.C.2. Telephone: TEMple Bar 9434.

Excellent reference books on electricity and productivity (8/6 each, or 9/- post free) are available—'Electric Motors and Controls' is an example.

E.D.A. also have available on free loan in the United Kingdom a series of films on the industrial uses of electricity. Ask for a catalogue.

7914/4

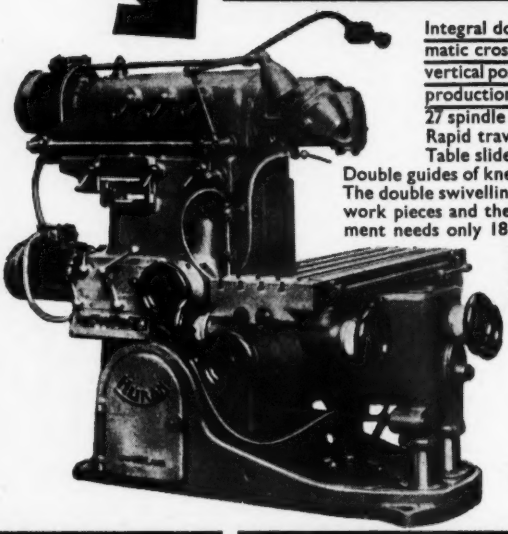
CUT HERE

SLIDING RAM GIVES 27½in. AUTO CROSS FEED

HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS



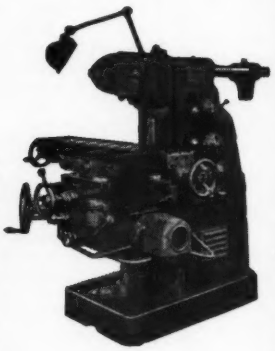
Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Head can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from $\frac{1}{16}$in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in. automatic cross movement needs only 18in. clearance. OPTIONAL EXTRA FEATURES: Mounted spacing casting assemblies providing additional 8in. capacity under spindle. 26in. wide 8 T-slot tables and 39⅜in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56½in. × 15⅝in.	43½in.	27½in.	19⅝in.
KU5	64½in. × 15⅝in.	51½in.	27½in.	19⅝in.
KU6	78⅝in. × 16½in.	59in.	27½in.	19⅝in.
KU55	64½in. × 26in.	51½in.	39⅜in.	18⅝in.
L83	157in. × 59in.	118in.	39⅜in.	59in.

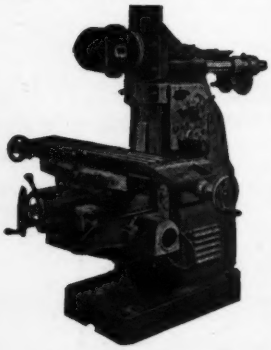
Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING HEAD; RETRACTABLE SLIDE BRACKET AND SPACING CASTING GIVING 26" DAYLIGHT ON No. 59 AND 21" ON No. 61



FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m Double swivelling universal head on retractable slide bracket providing with 5½in. Spacing Casting Drive assembly on 59 Machine 26in. daylight, and 21in. on No. 61.



MODELS 53 & 61. 16 universal head spindle speeds 21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ½-18¾in.

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ½-20in.

MODEL 54. Automatic cross feed of universal head 20in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds $\frac{1}{16}$-23¾in.

Type	Table	Automatic Feeds Long.	Cross	Vert.
53	43½in. × 9½in.	27½in.	9½in.	15⅝in.
61	47½in. × 10½in.	30½in.	9½in.	15⅝in.
59	51⅛in.× 11½in.	34½in.	11⅜in.	21⅛in.
54	67in. × 14½in.	43½in.	14½in.	20½in.

Send for full particulars of our very extensive range of these machines; ask for demonstration.

Rudolph Carne & Co. Ltd. SWAN WORKS, FISHERS LANE, CHISWICK, LONDON, W.4.

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Take no chances about your supplies of Rolled Thread Screws—specify ORMOND and so make sure of both quality and quantity—delivered right on time and straight from our extensive stocks. For your individual requirements, we will gladly submit special quotations. Send for lists, which in addition to detailing Brass, Steel and Light Alloy Screws in Rolled and Cut Threads, also feature Grub-screws, Nuts, All-threads, Hexagon Bolts and Set-screws turned from bar and Cold Headed Grades "A", "B" and High Tensile. The repetition parts range covers single and multi-spindle automatics up to 1½" diameter.

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EARLS COURT MARCH 21st–25th
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LARGE DRIP-PROOF MOTORS up to 600 horsepower

BROOK MOTORS LTD. BROOK ELECTRIC MOTORS HUDDERSFIELD · ENGLAND

59/7

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Leyland Motors have been satisfied customers of CARBORUNDUM for more than 30 years. They speak appreciatively of the excellent performance of CARBORUNDUM's standard grinding wheels ("Look at the finish on these reverse-gear-wheel bores: a 3-5 micron finish on a routine production job") and they point to some special wheels that CARBORUNDUM produced to Leyland's specification: designed specially for combined diameter and shoulder grinding on gearbox shafts, their special form makes them very much quicker and simpler to trim.

"Leyland have been well served by CARBORUNDUM for more than 30 years"

CARBORUNDUM can help YOU

In most of the major industries of the world, CARBORUNDUM is helping top firms to make better products, to cut costs, and to speed production. In the sharply competitive industrial climate of to-day there are three main conditions for success: high quality, low prices, and early deliveries. CARBORUNDUM can help you to meet them all.

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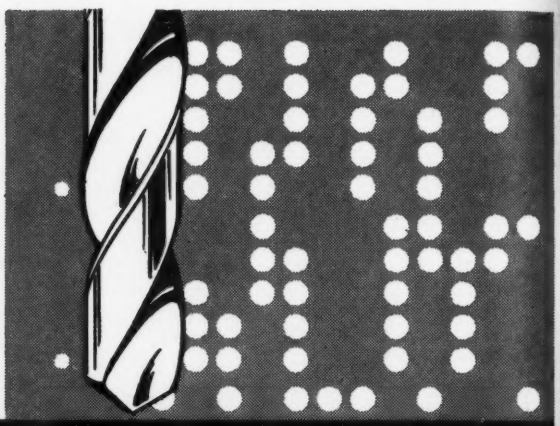


AIRMEC AUTOSET

for automatic drilling

POSITIONS THE WORK
Autoset automatic co-ordinate setting equipment provides accurate automatic control of the lead screws of a co-ordinate table. It enables the table to be positioned automatically by means of a punched tape (containing co-ordinate information for up to 400 operations) or manually by means of a series of knobs and dials.

SELECTS THE RIGHT TOOL
Facilities are provided for selecting one of up to ten tools and for controlling a large number of other variables such as tool rates, feed depths and spindle speeds.

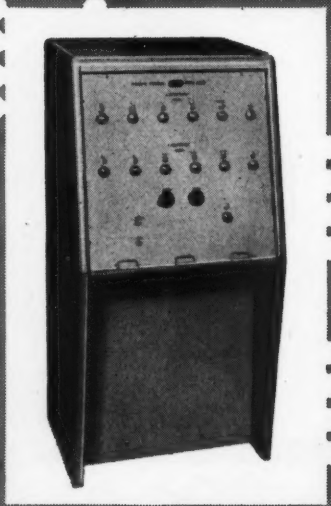
ROBUST AND RELIABLE
No electronic valves used.

EASY MAINTENANCE
Autoset has been designed for trouble-free service and easy maintenance.

CUTS OUT ERRORS
Autoset is highly accurate—automatic compensation is provided for table backlash and cumulative lead screw errors.

CUTS THE COST
A complete equipment for automatic control in two dimensions, including tape punch costs only £1,500. Manual control considerably less.

Descriptive leaflet No. 186 on request.



An Autoset fitted to Newall 15/20 Jig Borer. Full details from Newall Eng. Ltd., Peterborough.

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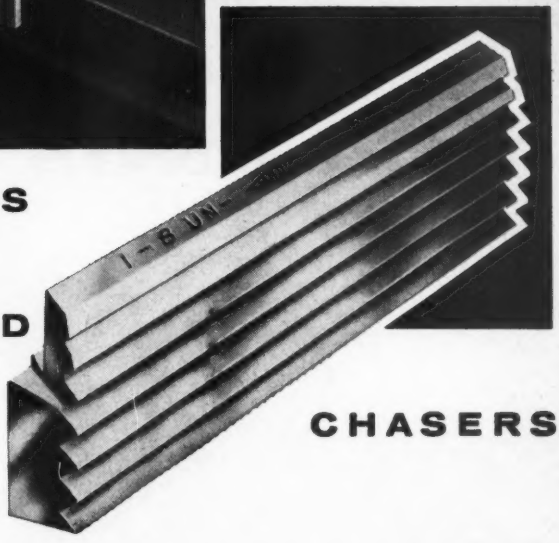

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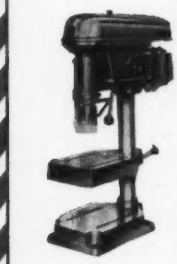

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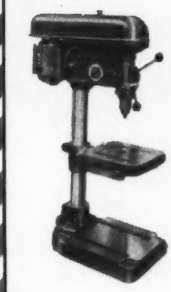

LB. 1 MK II
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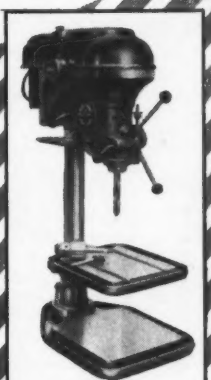

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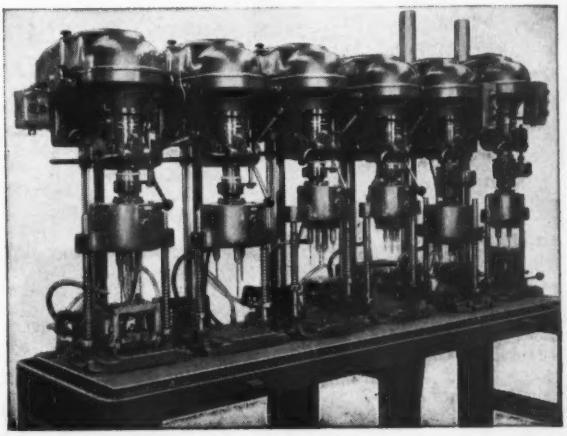
Have you investigated the possibility of using time-saving multi-spindle or multi-head methods on your components? We can supply anything from a simple 2-spindle attachment to a complete drill, ream, counterbore and tap sequence. Jigs and fixtures too, of course.



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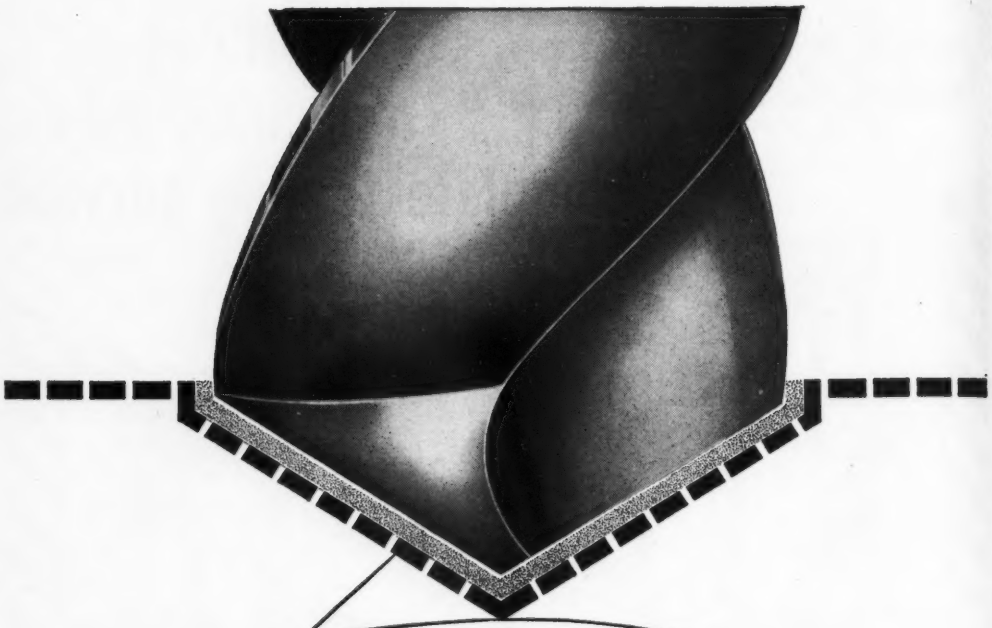

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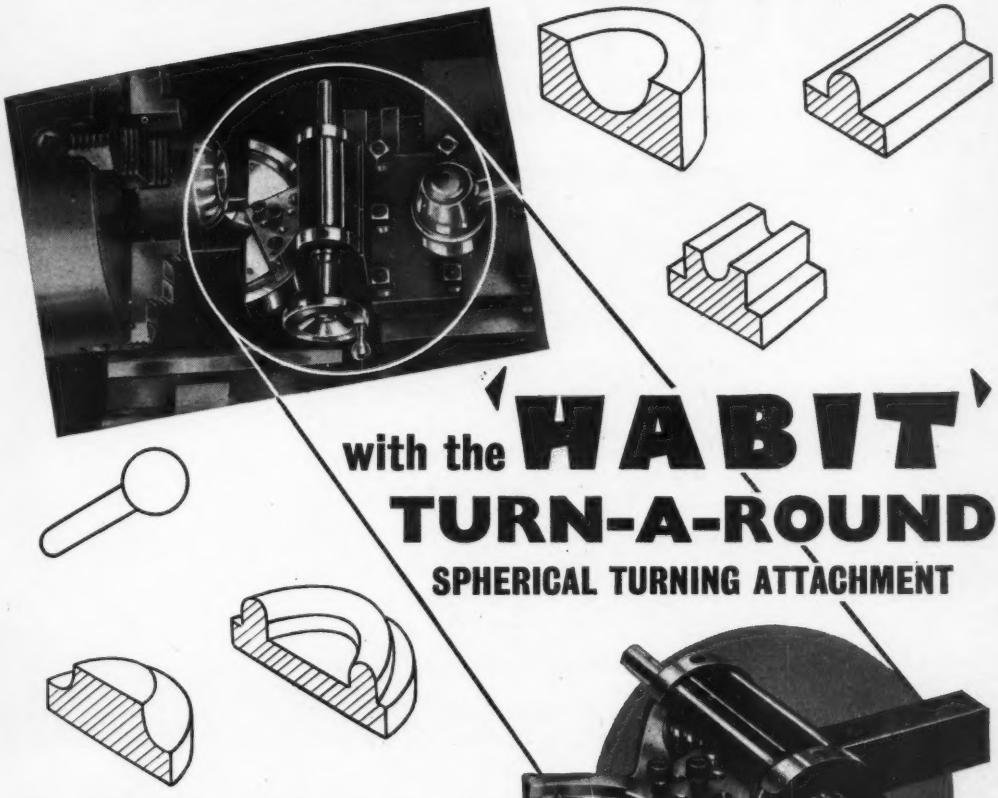

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TURN-A-ROUND

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Accurate spherical turning and convex and concave radius forming on lathes and shapers is simplicity itself with the TURN-A-ROUND — another HABIT toolroom innovation. Clamp it in the toolpost — set it with the aid of a simple chart — and turn the handle. A full 90° radius can be produced in one setting, or with twin tool bits — 180° of arc can be covered. The HABIT TURN-A-ROUND is versatile, robust, needs no special skill and will prove to be a vital part of every toolroom's equipment and every turners' kit.

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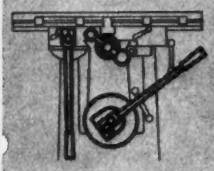
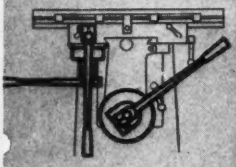
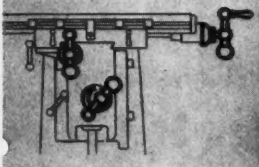


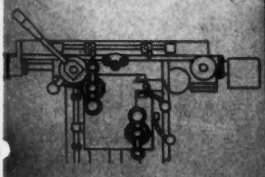
nd Feed—lever, screw, lever.



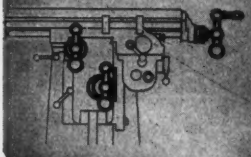
nd Feed—lever, lever, lever.



d Feed—Screw, screw, screw.



iform—semi-automatic cycle.



Normal automatic feed.

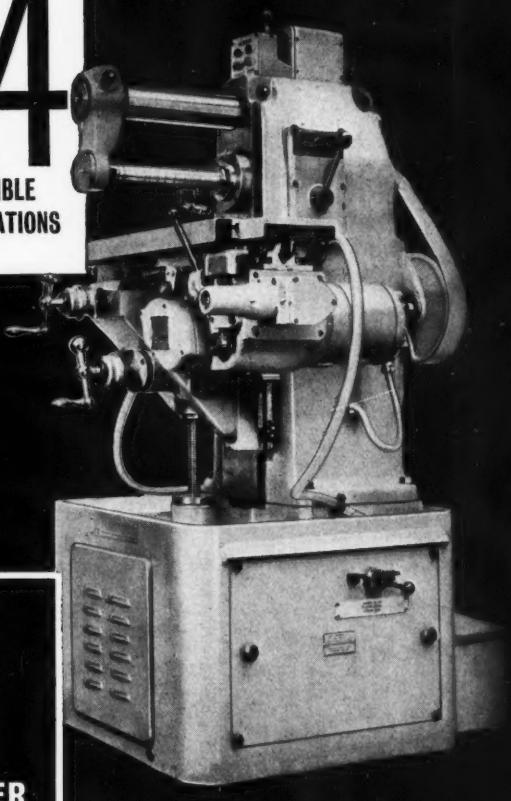
6 x 4 = 24

TYPES OF FEED | SPEED RANGES | POSSIBLE COMBINATIONS

that's the beauty of the

A&S

MODEL 'I' HORIZONTAL MILLER



6 With automatic cycle.

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When you equip with A. & S. Model '1' Millers you choose from 4 ranges of speeds and 6 different feed arrangements the best combination* for a particular job. Both hand-feed and automatic types can, however, be supplied with special attachments for special operations. No other small milling machine offers similar versatility or higher production capacity for so wide a range of work.

TABLE 26" x 7"
LONGITUDINAL TRAVERSE = 10"
VERTICAL TRAVERSE = 10"
TRANSVERSE TRAVERSE = 5½" - 6"

**With the A. & S. Model '1' brochure in front of you, you would know exactly what we mean.*

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For High Metal Removal and Sustained Accuracy

A new range of Shaping Machines designed primarily for the production shop where a high cutting capacity combined with accuracy is essential. Simplicity of operation is an outstanding feature. For the tool room or special purpose requirements a wide range of optional equipment is available.

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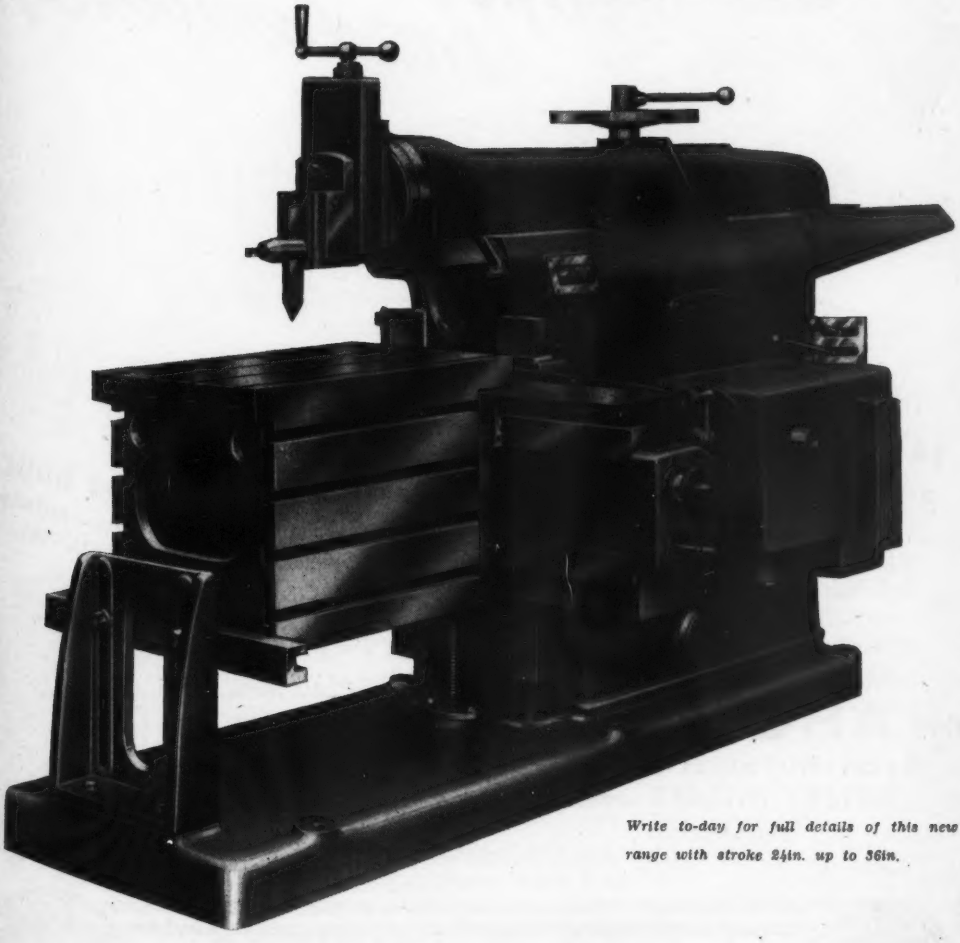

Write to-day for full details of this new range with stroke 24in. up to 36in.

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OS 435

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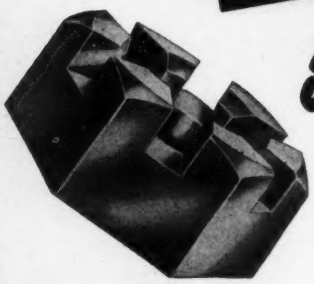

500 per hour slotted complete!

$\frac{1}{4}$" to $\frac{3}{8}$" Whit. ... 500 per hour
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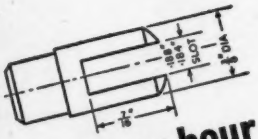
in mild steel



1450 per hour
Mill Slot-Fork End (A1-1)

780 per hour
Mill Slot and 2 Flats
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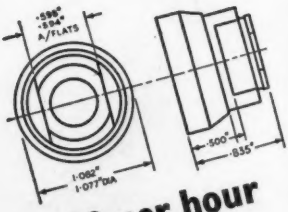

240 per hour
Mill 2 Flats—Actuator (EN7A-V1B)

Let AHCOL rotary milling machines do all your simpler milling jobs—slots, flats, faces, etc.—and release your elaborate millers and their highly paid operators for the more difficult work.

AHCOL millers are simple to operate and fast. Milling is continuous and automatic clamping can generally be arranged.

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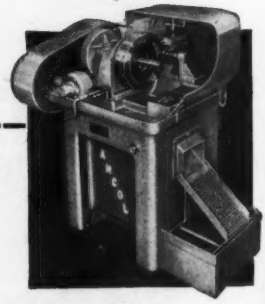
Semi-Automatic ROTARY MILLING MACHINES

	AHCOL STANDARD	AHCOL ROTAMILL
Work Drum dia.	12"	12"
Cutter dia.	4"	6"
Cutter width ganged	4"	6"
Motor	1 h.p.	5, 7½ or 10 h.p.



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and inspect the ROTAMILL at our Showrooms

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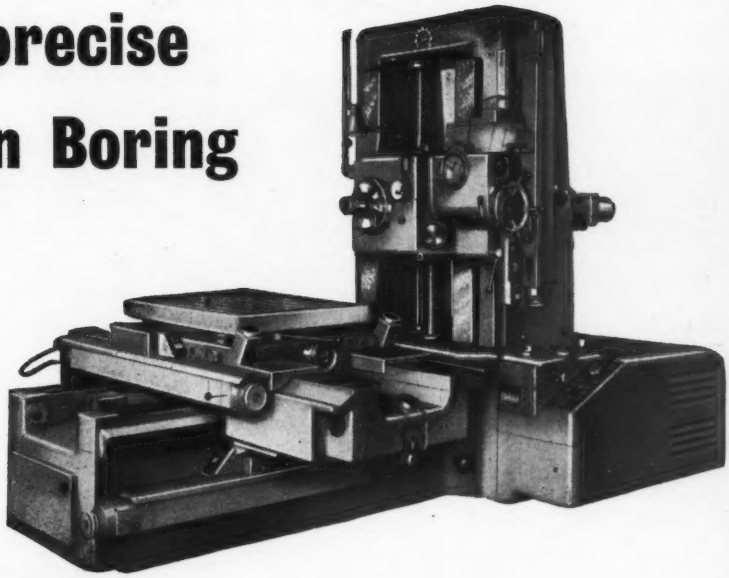

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HORIZONTAL OPTICAL JIG BORER MODEL 75 OG

With bridged double columns the DIXI '75' is immensely rigid. Optical settings direct reading to .00005″ are required for the first workpiece only and with semi-automatic positioning can be repeated quickly and accurately on subsequent components. Quick change pre-set tools permit rapid operation. Built-in rotary table has projected settings to 1 sec. and swivels through 360° permitting work to be machined from each side, or at compound angles, without disturbing its setting. Additional 17¾″ optical circular table with dividing accuracy of 1 sec. can be mounted horizontally or vertically.

Boring spindle dia. 3″. Table size 39⅜″ x 32″
Traverses: Longitudinal 23⅝″, transverse 29½″, vertical 25½″.

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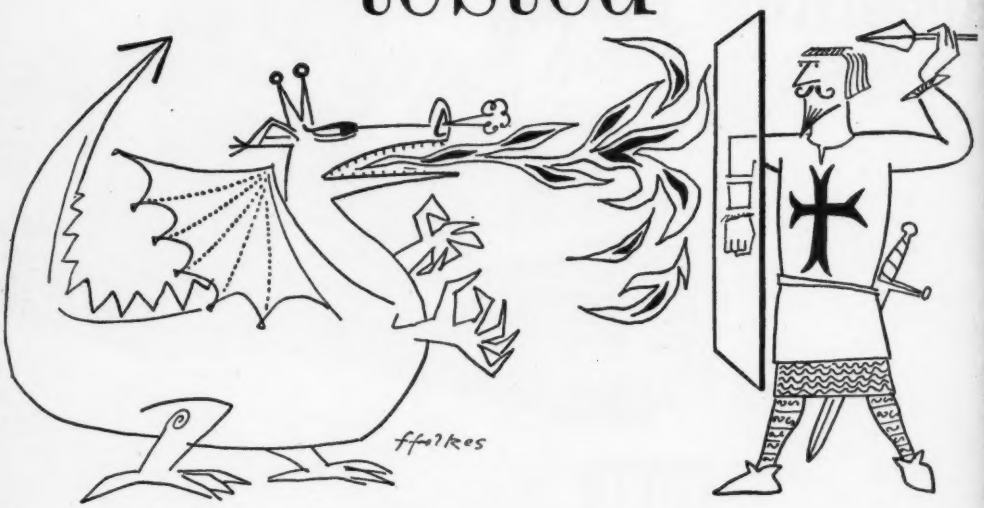

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For strength with vision

Extremes of heat (scientifically applied) are routine tests for 'Armourplate' Toughened Glass. These show its high resistance to thermal shock. It can be heated to 270 degrees Centigrade and then have cold water poured upon it; the splashing of molten metal upon it does not affect it. This thermal strength is coupled with a high degree of mechanical strength and clear, undistorted vision to make 'Armourplate' the ideal material for many industrial and engineering uses. For full details consult the Technical Sales and Service Department.

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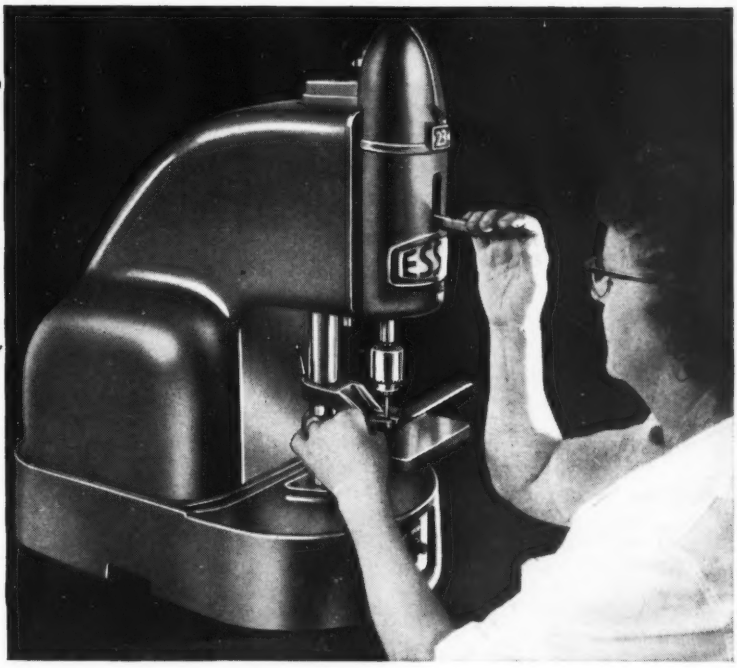
-NEW STREAMLINED DESIGN -SENSITIVE OPERATION



3 spindle speeds—forward and reverse.

Control by hand lever or foot pedal.

Spindle reverses when pressure on control is released.

Balanced driving clutches mounted on ball bearings.

No clutch adjustment necessary when changing tap diameter or work material.

Adjustable stops accurately determine tapping depth.

Worktable is adjustable for height and can be swung through wide arc.

Built in push button motor control.

Precision 3 jaw chuck included in standard equipment.

Follower attachment optional equipment.

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Capacity—Mild Steel	14-4 BA	9 BA-2 BA	8 BA-$\frac{1}{4}$" Whit
Capacity—Brass	14-3 BA	9 BA-$\frac{1}{4}$" Whit	8 BA-$\frac{3}{8}$" Whit
Maximum Feed of Spindle	$\frac{7}{8}$"	1"	1$\frac{1}{2}$"
Max. Distance Table to chuck	4"	5$\frac{1}{8}$"	15$\frac{1}{2}$"
Dimensions of Table	4$\frac{1}{2}$" x 4$\frac{1}{2}$"	6" x 6"	13" x 8$\frac{1}{2}$"
Chuck Capacity	$\frac{1}{4}$" dia.	$\frac{1}{4}$" dia.	$\frac{3}{8}$" dia.
Spindle Speeds (Forward)	1010, 1440, 2050 R.P.M.	830, 1180, 1680 R.P.M.	480, 930, 1500 R.P.M.
Spindle Speeds (Reverse)	1010, 1440, 2050 R.P.M.	830, 1180, 1680 R.P.M.	690, 1340, 2150 R.P.M.
Motor	$\frac{1}{2}$ H.P.	$\frac{1}{3}$ H.P.	$\frac{1}{2}$ H.P.

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cuts machining time by 60%

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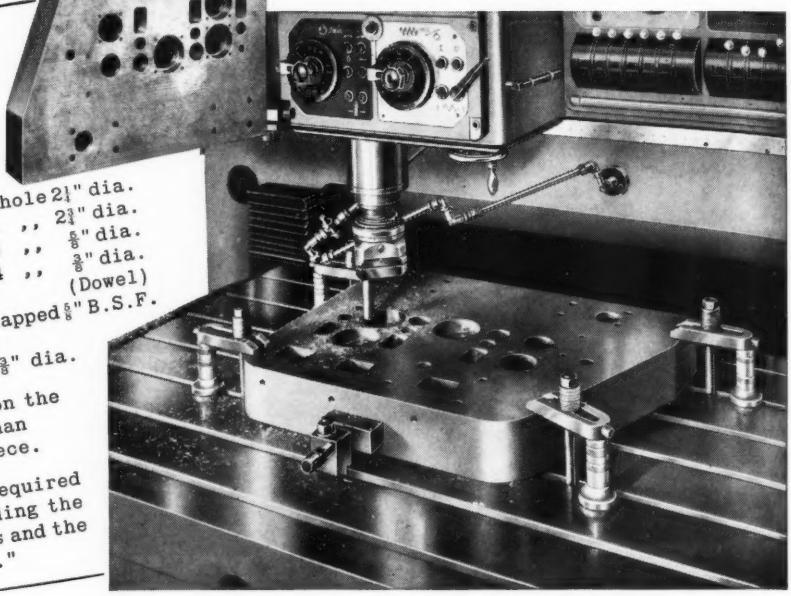
"In the cast iron drive side frame for our rotary cutter scoring machine we machine 24 holes;

2 holes 3⅝" dia.
1 ,, 3¼" dia.
3 ,, 1¼" dia.
2 ,, 1 13/16" dia.
2 ,, 1" dia.
1 hole 2¼" dia.
1 ,, 2⅛" dia.
5 ,, ⅝" dia.
4 ,, ⅜" dia. (Dowel)
1 ,, drilled and tapped ⅝" B.S.F.
2 ,, ⅝" dia. and spot face 1⅜" dia.

Machining time on the BEMAG is less than 3½ hours per piece.

Former method required 8¾ hours excluding the 5-⅝" dia. holes and the ⅝" tapped hole."



The BEMAG Co-ordinate Boring & Milling Machine for JIGLESS production represents a revolutionary approach to single, batch and mass production boring.

- MANUAL PRESELECTION OR AUTOMATIC PROGRAMMING OF CO-ORDINATES
- SIMPLE PUNCHED CARD PROGRAMMING SYSTEM —NO ELECTRONICS
- BRIDGE TYPE COLUMN AND REMOVABLE TABLE FACILITATE MACHINING LARGE WORK-PIECES
- ALL SLIDES AUTOMATICALLY CLAMPED
- POWERED DRAW BAR FOR RAPID TOOL CHANGING
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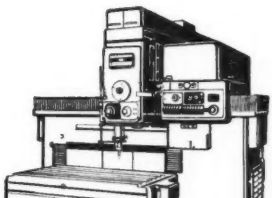
- LONGITUDINAL SPINDLE MOVEMENT 50", CROSS 30"



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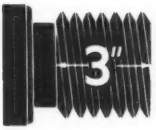
BEMAG 5

MATRIX QUALITY THREAD GRINDERS give you toolroom precision plus production line speed. Traverse grind as fine as

or leads as coarse as

Plunge grind threads 

long in a turn and a half Wheels formed by multi-rib or single-rib diamond dressers or manual or automatic crushing units. Furthermore, crush formed wheels are ideal for grinding intricate profiles.

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Table tilts 15° in both directions

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THE "MICRONIC" ADJUSTABLE NEEDLE BEARING

Now fitted as standard to the spindles of all TORNOS Automatics, the Micronic bearing can be adjusted, WITHOUT DISMANTLING to suit all conditions . . . high speeds for light metals . . . medium speeds for mild steels . . . low speeds for special steels.

The design gives very great strength and rigidity enabling deep cuts and heavy tool pressures to be used (such as knurling) without a steady bush. There is very little wear even at the highest speeds enabling precise accuracy to be maintained throughout a long life.

Gives

TORNOS
SLIDING HEAD AUTOS

unsurpassed versatility and productive capacity

TORNOS AUTOMATICS
include the following sizes:

MODEL	MAX. DIA. BAR
M4	5/32 ins.
M7	9/32 ins.
R10	15/32 ins.
R16	5/8 ins.
RR20	25/32 ins.
MR28	1.3/32 ins.
MR32	1.1/4 ins.

TORNOS SALES COMPANY (E. M. VAUGHAN LTD.)
301 BROADGATE HOUSE, COVENTRY
Telephone: COVENTRY 26815 Telex. TORNOS COV. 31541

ACKWORTHIE
THE MULTI-DRILL-HEAD SPECIALIST

FOR PRECISION DRILLING

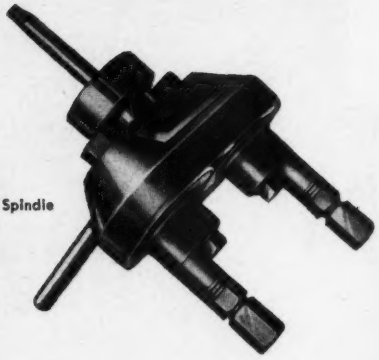

Fig. 201. 2 Spindle Adjustable.

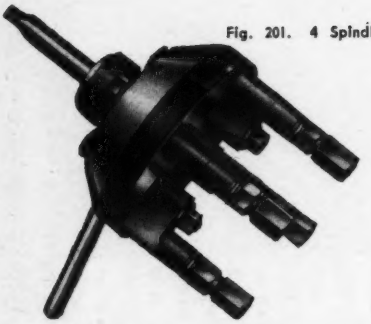

Fig. 201. 4 Spindle Adjustable.

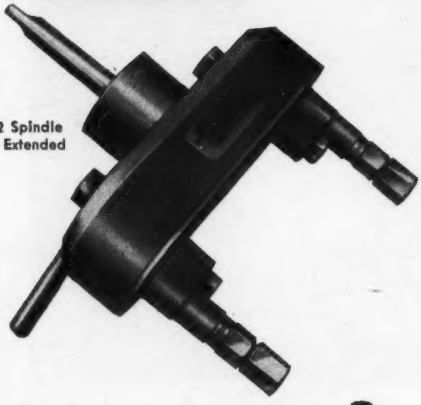

Fig. 201. 2 Spindle Adjustable Extended Centres.

Manufacturers of Multi-spindle Drilling Heads and Tapping Heads, fixed or fully adjustable.

Special designs executed to customer's requirements. All these Standard Attachments will fit your Drilling Machines.

Send for your copy of 'Automation by Ackworthie/H' and consult our Technical Advisory Dept. on your Drilling and Tapping problems.

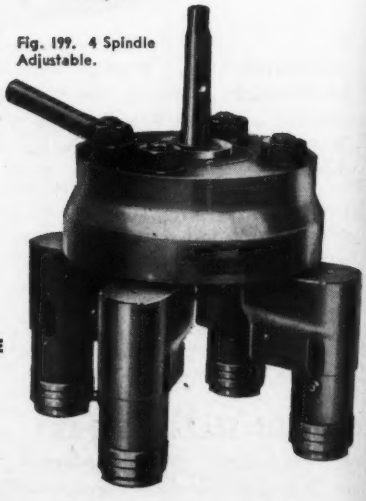

Fig. 199. 4 Spindle Adjustable.

ACKWORTHIE

JOHN ACKWORTHIE LTD.

DALEHOUSE LANE · KENILWORTH · WARWICKSHIRE

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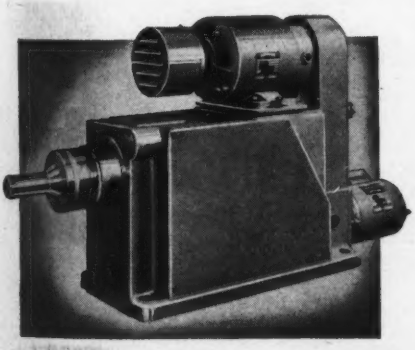
Precision x 4...

For this 4-head
Precision Boring Set-up
at their Hillington Factory

ROLLS-ROYCE *selected*

H.P.E Fine Boring Unit Heads



May we help with your Fine Boring problems? We offer a range of standard heads and base units together with a technical design service for special machines.

H·P·E

An Associated Engineering Limited Company

HIGH PRECISION EQUIPMENT LTD · Bletchley · Bucks · Tel. Bletchley 3403/4/5

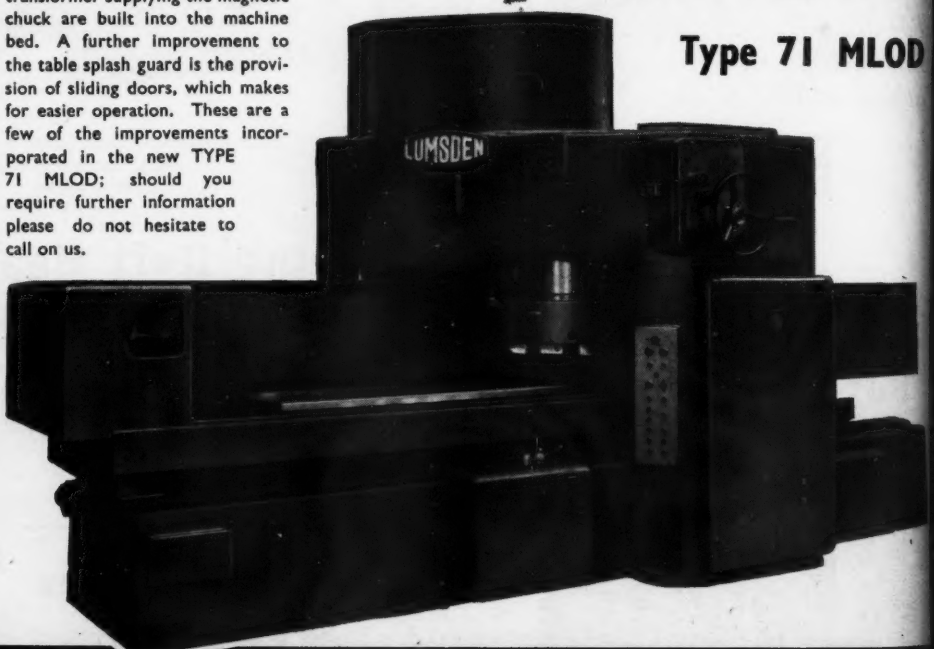
The Latest LUMSDEN

Reciprocating Table SURFACE GRINDER

Type 71 MLOD

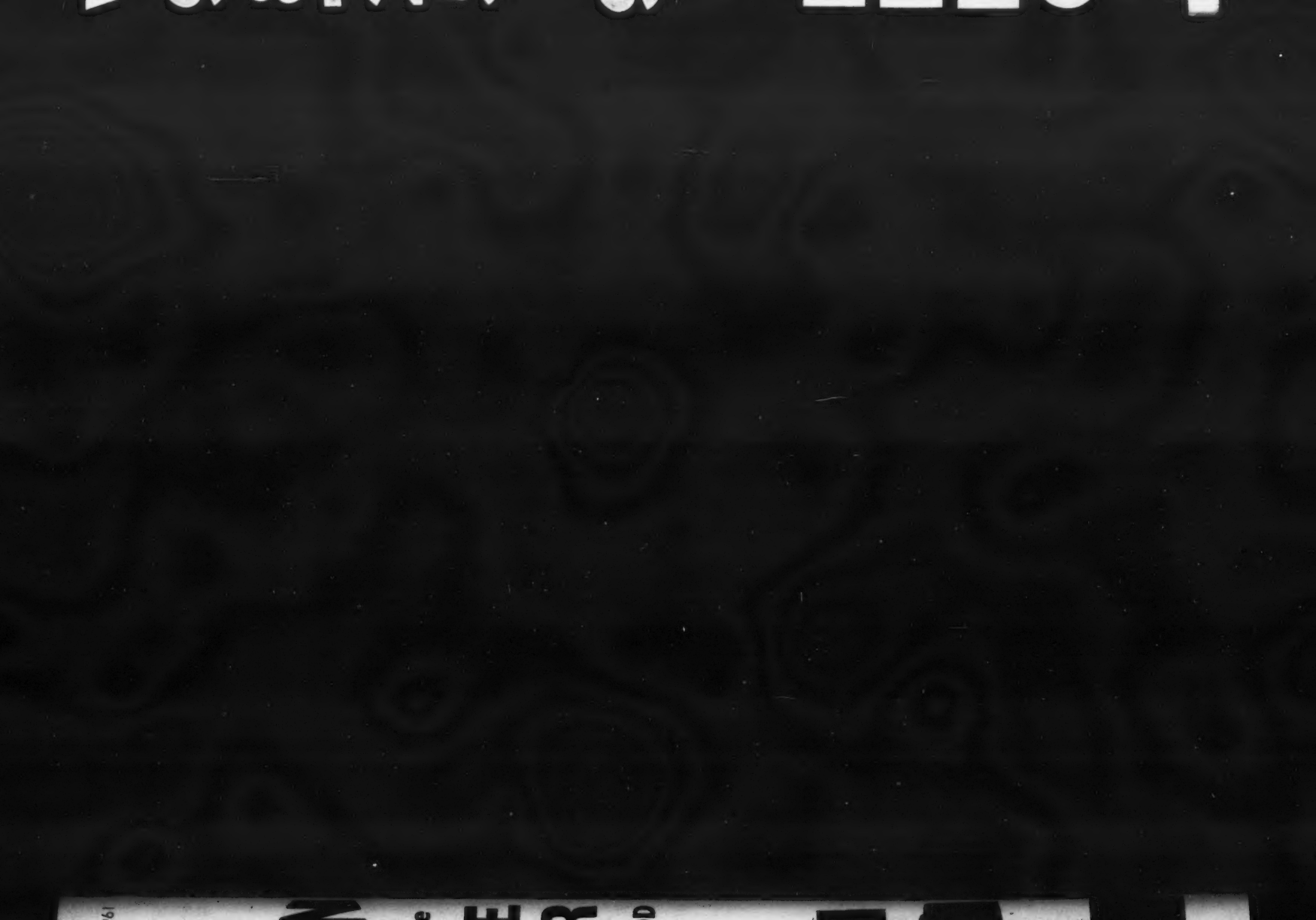
This is the latest development in the range of LUMSDEN Reciprocating Table Machines. Its design retains the double column support for the bridge, but the columns have been angled to provide easier access to the table. Other improvements to be found on TYPE 71 MLOD include an improved feed arrangement for the wheel and the incorporation of power elevation for rapid movement of the grinding head. Hydraulic controls of new design have been repositioned to give easier operation. Lubrication of the entire machine is fully automatic, with special provision for the table ways which now have 100 per cent. protection. The spindle motor is mounted inside the bridge, from which new position its drive is transmitted to the spindle through a Power Grip belt.

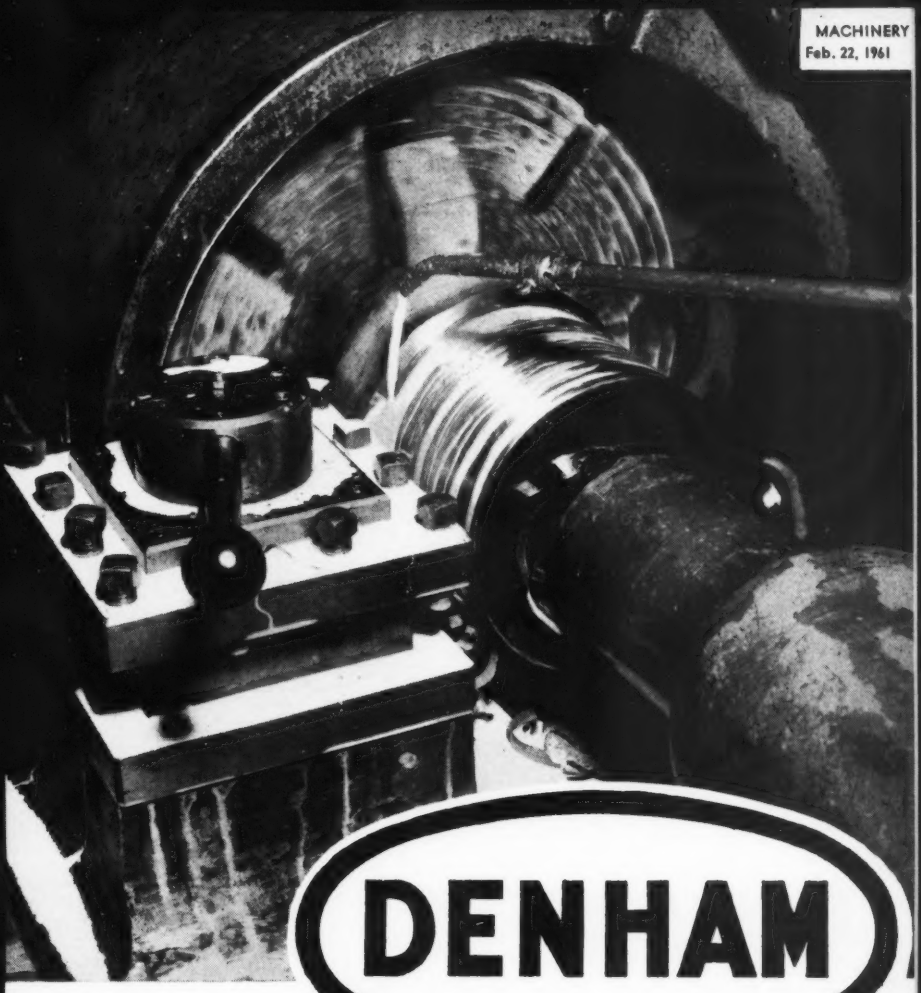
Control equipment for the motors is now housed within the column and the push button station, which includes controls and signals for the magnetic chuck, is mounted within easy reach of the operator. Both rectifier and transformer supplying the magnetic chuck are built into the machine bed. A further improvement to the table splash guard is the provision of sliding doors, which makes for easier operation. These are a few of the improvements incorporated in the new TYPE 71 MLOD; should you require further information please do not hesitate to call on us.



THE LUMSDEN MACHINE CO. LTD. GATESHEAD, ENGLAND

SOLE AGENTS: ALFRED HERBERT LTD. COVENTRY





DENHAM

machining NIMONIC billets

AT HENRY WIGGIN & CO. LTD.

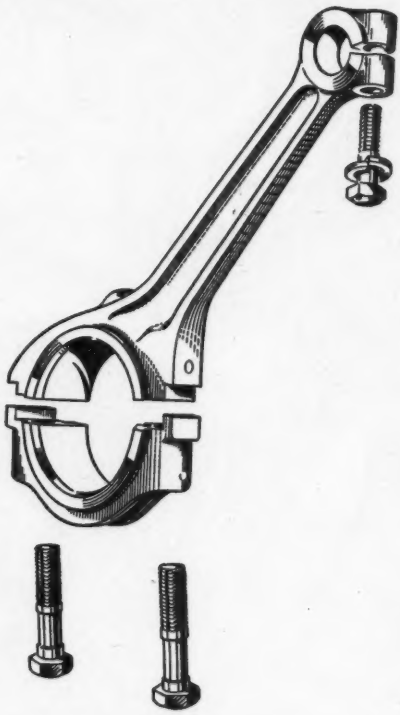
23 machines are installed for billet and bar-turning. The as cast billets are barrel-turned and faced prior to an extrusion operation which leaves the billet " header " as the press discard. In the illustration a Nimonic 80A billet is being turned at 25 rpm with 0·011in./rev. feed and $\frac{1}{4}$in. deep cut.

HEAVY DUTY LATHES FOR EVERY PURPOSE

DENHAM'S ENGINEERING COMPANY LIMITE
HALIFAX ENGLAN

PARK GATE

QUALITY STEELS FOR DROP FORGINGS



1823 EXPERIENTIA DOCET 1961

black bars

for

connecting rods

THE PARK GATE IRON & STEEL COMPANY LIMITED ROTHERHAM

A Tube Investments Company TELEPHONE: ROTHERHAM 2141 (15 lines) TELEGRAMS: YORKSHIRE, PARKGATE, YORKS. TELEX 56141

KUMMER K20

SEMI-AUTOMATIC TWIN HEAD PRECISION LATHE

with NEW features

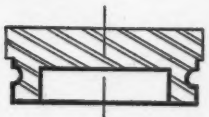
Ideal for second-operation work on concentric and profiled shaped parts, including bar work, castings, forgings, stampings, etc. New device for stopping spindle in a set position for loading components. Two speed device is fitted so that the work head spindle can automatically operate at high or low r.p.m. according to preselected cutting speeds. Camshaft driven from the main spindle.

Cam accelerator is another accessory to reduce machining cycle time. Tool setting can be carried out away from the machine with a special tool setting gauge.

Each work head is completely screened. By means of a cam mechanism fitted to the end of the tool slides, the retraction of these slides carrying the cutting tools can be made to allow easy loading of components into the chucks.

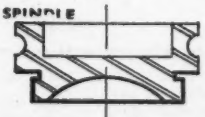
Example of KUMMER *Productivity*

No. 1 SPINDLE



Material: Stainless steel (163 Brinell).
Cycle time: 47 secs.
Loading: 6 secs.
Scale: 1 : 1.

No. 2 SPINDLE



Material: Component from Op. 1 as above.
Cycle time: 47 secs.
Loading: 6 secs.
One complete piece in 53 secs. utilising the unique features of the KUMMER Model K.20 machine.

GASTON E. MARBAIX LTD.

DEVONSHIRE HOUSE, VICARAGE CRESCENT, BATTERSEA, LONDON, S.W.11 Phone: Battersea 8888 (8 lines)

NRP 3241

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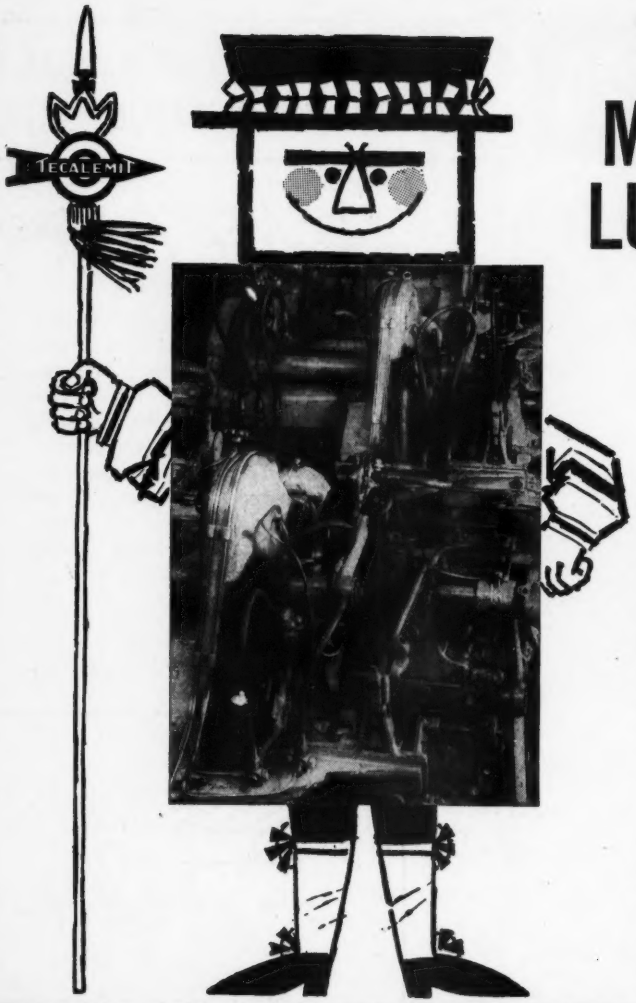

TECALEMIT MECHANICAL LUBRICATION

The guardian of your machines

Tecalemit Mechanical Greasing Systems guard every bearing. Fitted into new designs or existing machinery, they ensure correct greasing at the correct intervals, eliminate neglect and error, and immensely increase the working life and efficiency of your machines. And by cutting out hand greasing, they add much to works safety.

The two main grease systems are suitable for every type of installation.

The SINGLE-LINE SYSTEM

has a central pump—fully automatic, operator controlled, or hand operated—and a single main distributor line, feeding each bearing through a separate single-line injector, each of which is independently regulated.

The RADIAL SYSTEM

is fully automatic, and uses 19 miniature pumps to serve individual bearings. Each pump's output is pre-regulated. The unit can be driven from the machine it serves, or supplied with its own electric motor.

Tecalemit Mechanical Lubrication can solve your problems and speed your production.

Fill in this coupon and post it today. If you have a particular application or trouble-spot in mind, by all means enclose a note, a sketch or a drawing. You will be under no obligation whatsoever.

To TECALEMIT LTD (Sales MT) Plymouth, Devon

Please send me full information on:

- ☐ Tecalemit SINGLE-LINE Grease Injection systems
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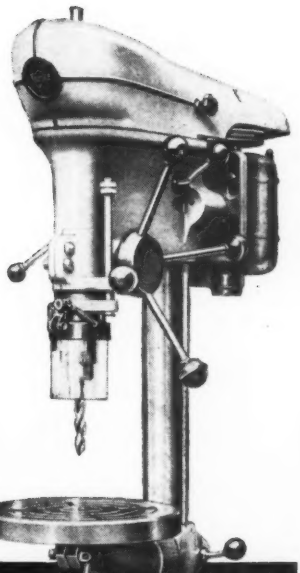
KERRY



KERRY ¾ INCH CAPACITY SUPER "8" SPEED DRILL

A production and general purpose jobbing machine, robustly constructed to ensure absolute reliability under the most arduous operating conditions. Features that have made this Super "8" so popular include a wide speed range — from 86 to 3,360 r.p.m. or 45 to 2,000 r.p.m. and adaptability for such applications as drilling, reaming, tapping, lapping, trepanning, etc. Tens of thousands are in use throughout industry today. The Super "8" is available as a bench, pedestal or line production model together with a complete selection of attachments for special application.

BENCH DRILLING MACHINES

THE KERRY "DRILLMASTER"

A ½ inch capacity production drilling machine designed for continuous operation over long periods. The "Drillmaster" can be supplied with a low, standard, or high speed range to suit customers' requirements. Each model has 4 spindle speeds ranging — in the low speed machine from 300 to 2,200 r.p.m. — the standard from 617 to 3,360 r.p.m., and the high speed machine up to 7,000 r.p.m. Bench, pillar and line production models are available in the above speed ranges.

KERRY'S

manufactured within the KERRY GROUP by
KERRY'S (Engineering) CO. LTD
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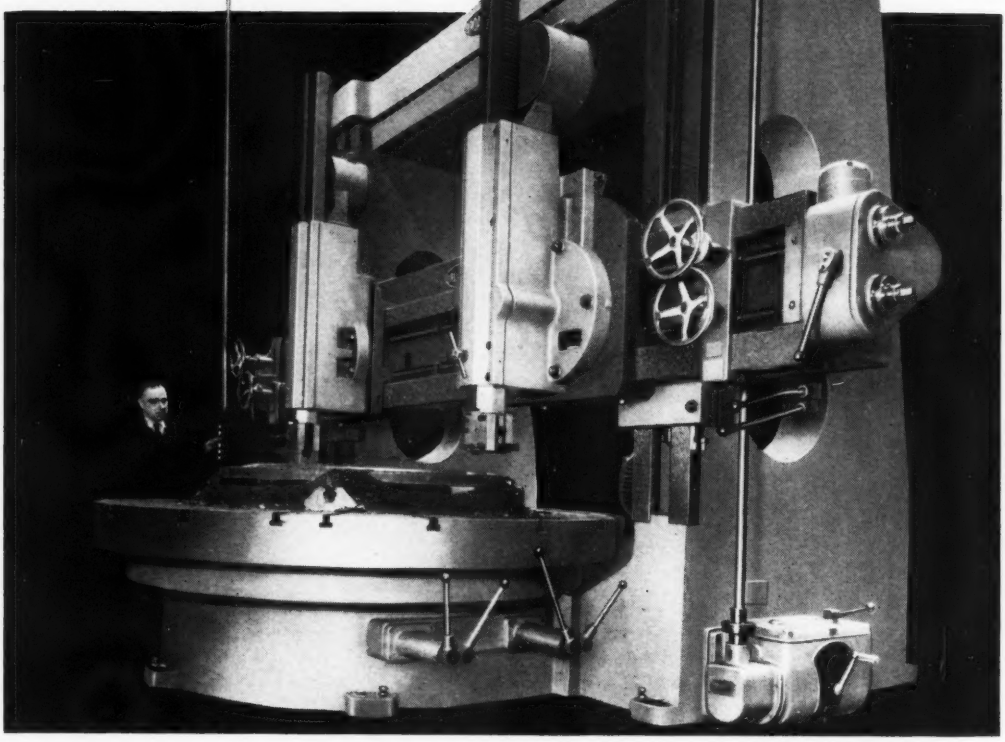
BROADBENT



HEAVY DUTY Vertical BORING & TURNING MILLS

with 5, 6, 8 or 10 ft diameter work tables

These incomparable machines are massively constructed for years of hard service. Accuracy and dependability are of the high order that industry has learned to expect of Broadbent Machine Tools. Notable features of these Boring and Turning Mills include twelve changes of speed and six changes of feed, controllable from either side of the machine; spiral bevel and spur reduction gears driving the work table; pendant control of rams and cross slides; and rapid power traverse with independent control of the two heads.

Please write for fully illustrated brochure.

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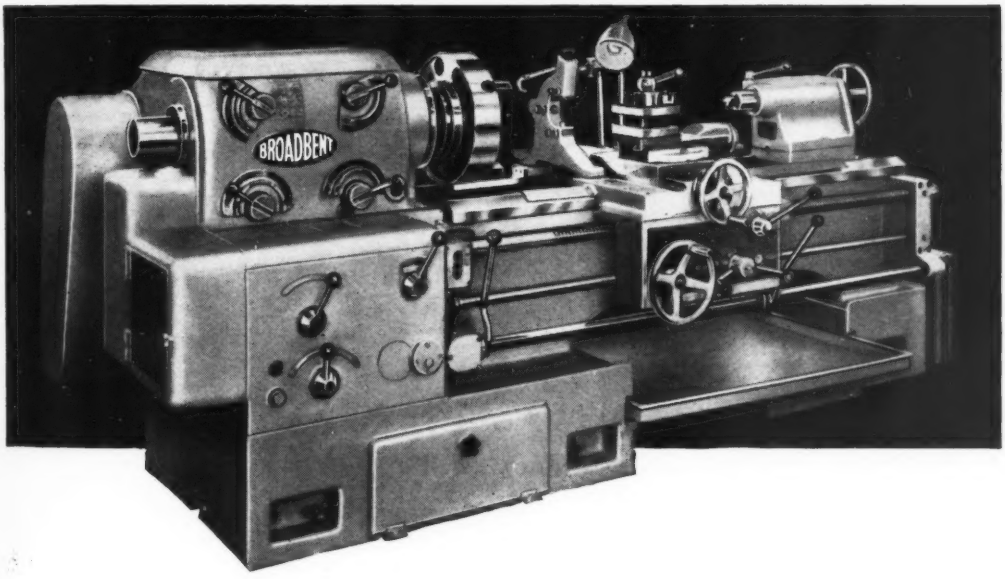
Broadway HBB

MORE output per man-hour with

Good men plus good tools equal good output. Every Broadbent lathe incorporates almost a century of machine tool building. Manufacturers know that for versatility, accuracy and reliability there is nothing quite as good as a Broadbent Machine Tool.

BROADBENT

LATHES



This 18/22″ Swing Heavy Duty Centre Lathe of modern design is a typical example of the Broadbent range. It has a 15 h.p. drive motor and spindle speeds up to 1,000 r.p.m.

The Broadbent range of Machine Tools includes Surfacing and Screw-cutting Lathes from 17″ to 72″ swing, Surfacing and Boring Lathes, Break Lathes, Crankshaft Lathes and vertical Turning and Boring Mills with 5′, 6′, 8′ or 10′ capacity.

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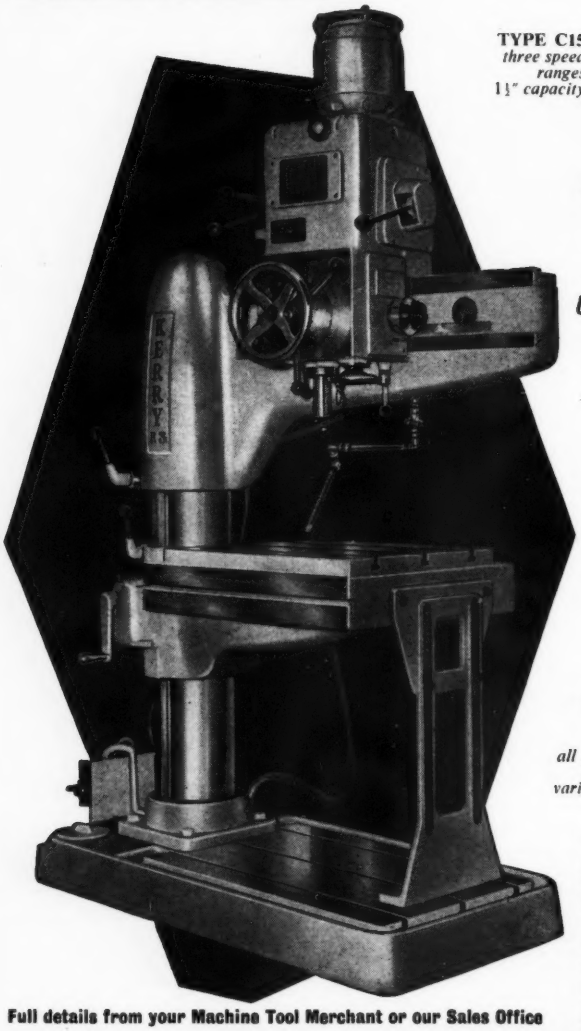
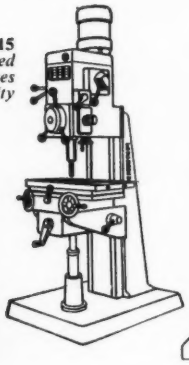
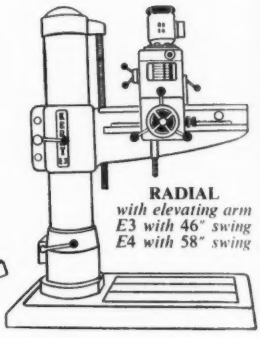
Broadway/HB9

KERRY RANGE OF DRILLING MACHINES



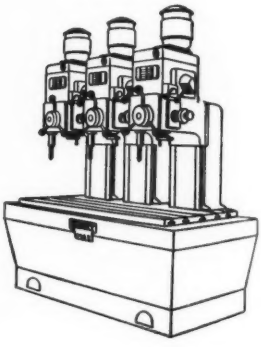
TYPE C15
three speed ranges
1½" capacity





RADIAL
with elevating arm
E3 with 46" swing
E4 with 58" swing

MULTI-HEAD
MS 3
line production unit 1½" capacity



TYPE 150 AG
all geared head also 150 IV infinitely variable 1½" capacity

Full details from your Machine Tool Merchant or our Sales Office

The Radial Drill illustrated on the left is available in 2 models. The R3 has a swing of 36", the R4, 48". Both models have a capacity of 1¼" in steel and 1½" in cast iron, 9 spindle speeds ranging from 90 to 1120 r.p.m., quick hand traverse, fine hand feed and three rates of power feed. The Kerry range of drilling machines includes bench, pillar and line production models with drilling capacities from ½" to 1½".

Q&S

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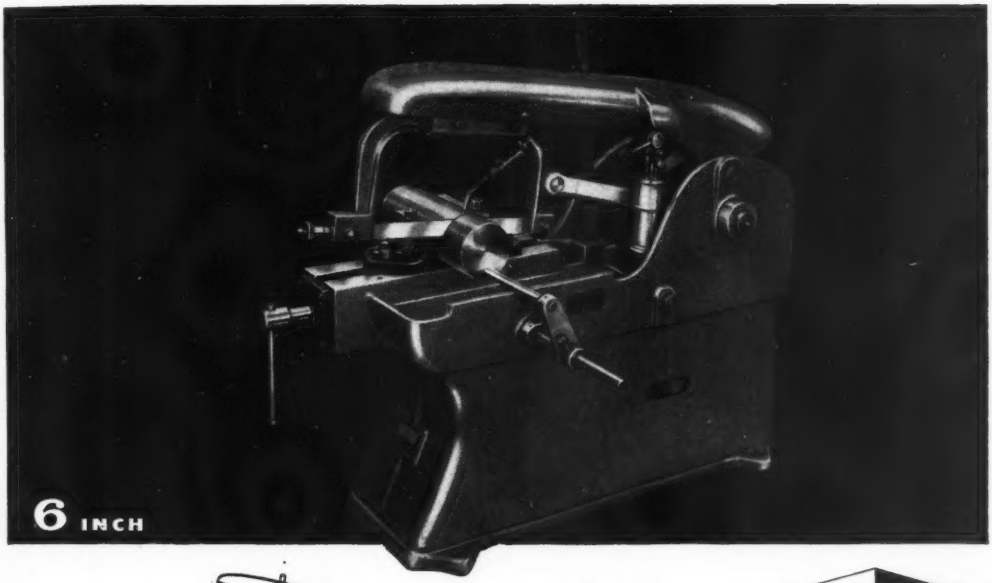
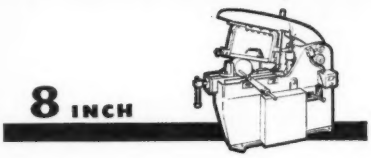
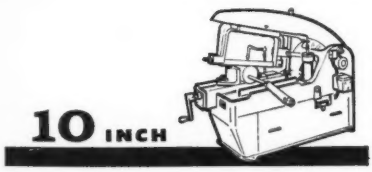
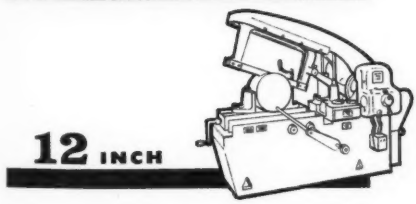
Broadway QS11









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The Famous Q&S

SAWMASTERS

are the finest HEAVY DUTY HACKSAWS in the world

Modern in design, robust and precise in construction, these unrivalled machine saws cut accurately and rapidly, and offer maximum production efficiency. Refinements include totally enclosed drive, hydraulic relief on the return stroke and automatic lifting of the bowslide to loading position on completion of cut.

Instant lever selection of correct cutting speed is a feature of all but the smallest model.

—and the famous SAWMASTER Autocut Power Bandsaw.

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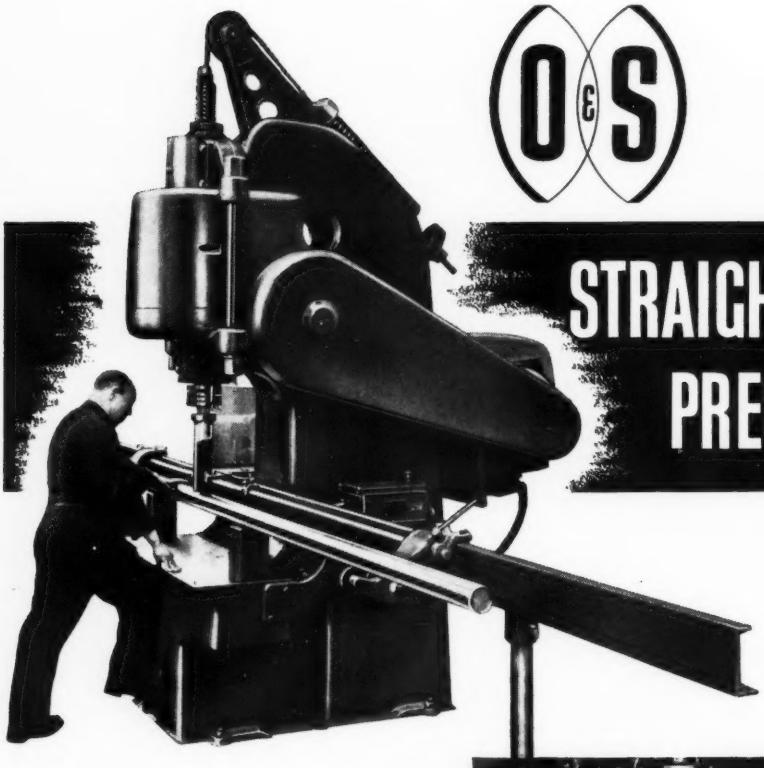
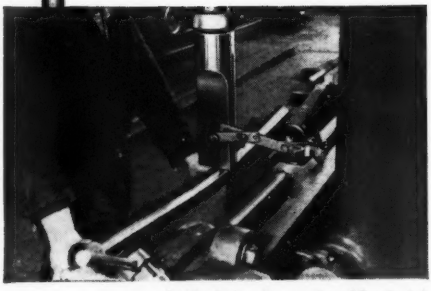
O & S

STRAIGHTENING PRESSES



O & S Straightening Presses, made in 5 sizes with capacities ranging from 4 to 60 tons pressure, have for many years been the first choice of engineering firms throughout the world, including most of the leading motor manufacturers. For speed, accuracy and ease of operation, O & S Straightening Presses are in a class of their own.



In the Leicester works of Frederick Parker Ltd., O & S Straightening Presses are in daily service ensuring that steel shafts are perfectly straight and true.

O & S

manufactured within the KERRY GROUP by
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BOOTHTOWN, HALIFAX, YORKSHIRE

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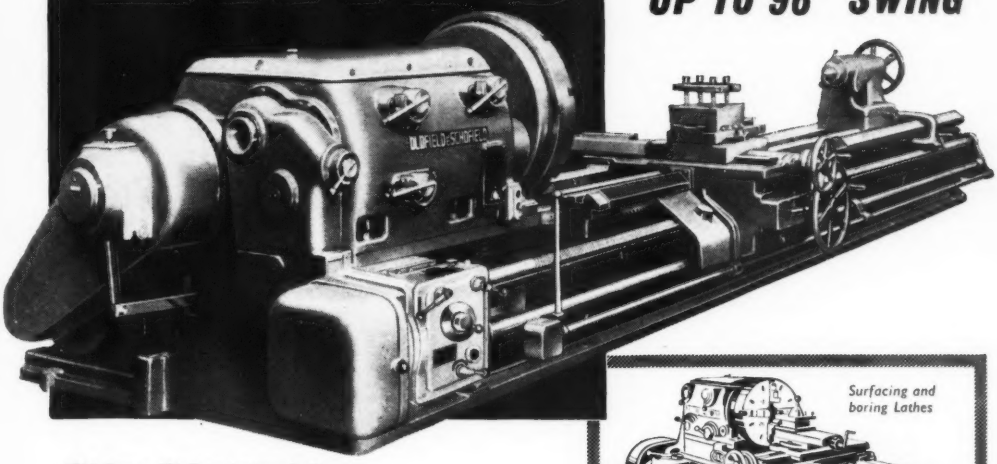
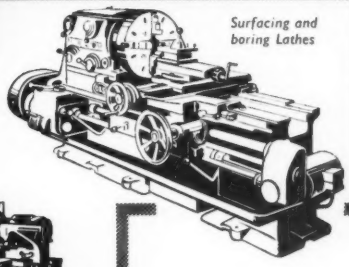
Heavy Duty LATHES

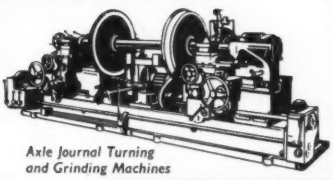
UP TO 96" SWING



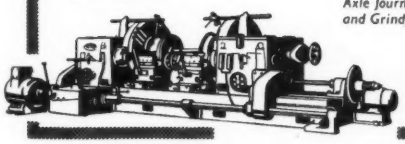
18½" Centre 'D' Type Lathes. Built in sizes up to 48" swing.



Surfacing and boring Lathes



Axle Journal Turning and Grinding Machines



Heavy Duty Double Wheel Lathe

O & S have for many years manufactured a wide variety of heavy lathes which have earned for the company a fine reputation for precision engineering and first class craftsmanship. The range includes Surfacing and Boring Lathes up to 96" swing, Brake Lathes, Axle Lathes, railway carriage and waggon wheel lathes, axle journal turning and burnishing lathes etc., all embodying the latest developments in modern lathe design.

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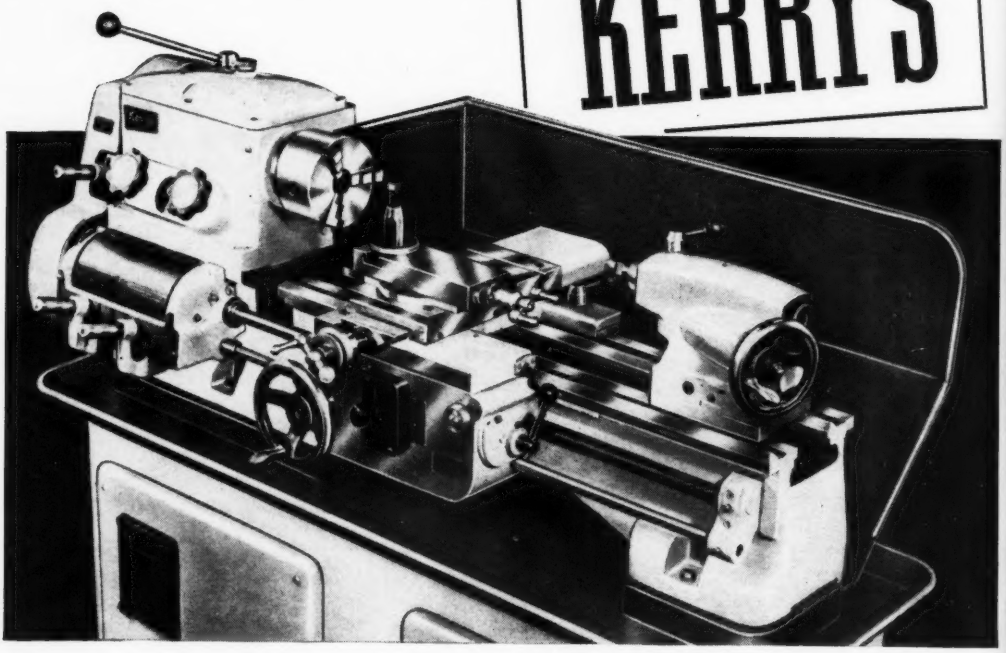
MORE AND MORE ARE TURNING TO KERRY'S



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'Fluon' cuts maintenance costs, increases efficiency for Johnson, Matthey and Company Limited

Preformed packing rings made from plaited asbestos rope impregnated with 'Fluon' p.t.f.e. by Crane Packing Limited, are used for gland packings in the centrifugal pumps at Johnson, Matthey and Company Limited. These pumps handle highly corrosive nickel sulphate solutions, containing abrasive materials, up to temperatures of 70°C. These solutions attack all hydrocarbon lubricants, causing conventional gland packing rings to harden.

Johnson, Matthey and Company Limited had to adjust the former gland packing daily and replace packing rings every 200 pump-working hours.

Since changing to asbestos/'Fluon' packing rings there has been a remarkable improvement. At first, gland adjustments were made every two or three days. After a few weeks *no attention was needed at all.* The rings were found to be in *perfect condition after 7,000 hours'* pumping the abrasive-free nickel sulphate solution. When the solution contained abrasives, the life of the rings was slightly shorter, but *many times longer than that of any other packing.*

Trials were run over two six-month periods and these results were obtained:

(1) 67 conventional packing rings were replaced, over six months, in five 2" pumps. In the next six months, only 4 asbestos/'Fluon' rings were replaced.

(2) 168 conventional packings were replaced, again over six months, in five 2½" pumps. Over the following six months, only 31 asbestos/'Fluon' ones were replaced.

Initially, these new rings cost more. The extra cost is offset many times over in reduced maintenance costs and greater running efficiency of the pumps.

Pumps which handle highly corrosive nickel sulphate solutions, containing abrasive materials, up to temperatures of 70°C., at Johnson, Matthey and Company Limited, Brimsdown, Middlesex, showing asbestos/'Fluon' gland packings made by Crane Packing Ltd., Slough. The inset shows a close-up of the packing rings in one of the centrifugal pumps.

Plaited asbestos rope impregnated with 'Fluon' p.t.f.e. and made into preformed gland packings by Crane Packing Ltd., Slough.

'FLUON'

'Fluon' is the registered trade mark for the polytetrafluoroethylene manufactured by I.C.I.

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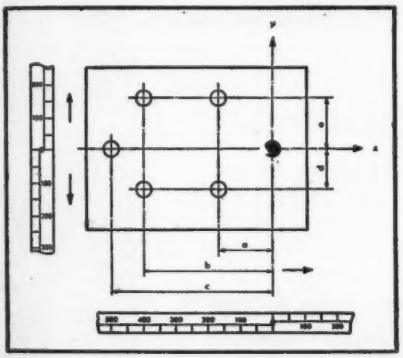

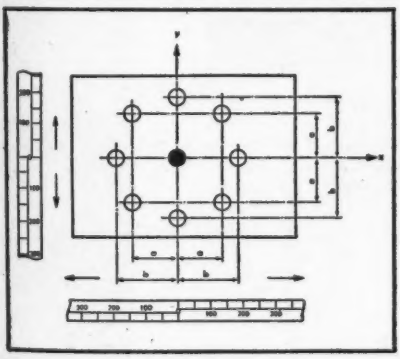

Scales with opposed graduations eliminate conversion of co-ordinate dimensions when working on both sides of the zero point of a co-ordinate axis and allow workpieces to be completed without special drawings and without determining an auxiliary starting point. The diagrams opposite demonstrate this advantage. The optical projection equipment provides for the setting and reading of scales to 0·000025 in. without difficulty. Zero setting of the fine scales is effected by push-button control.

Not only is the setting and reading of co-ordinate values simple and speedy, but the next co-ordinate values can be pre-selected whilst machining the previous bore, an advantage for production work.

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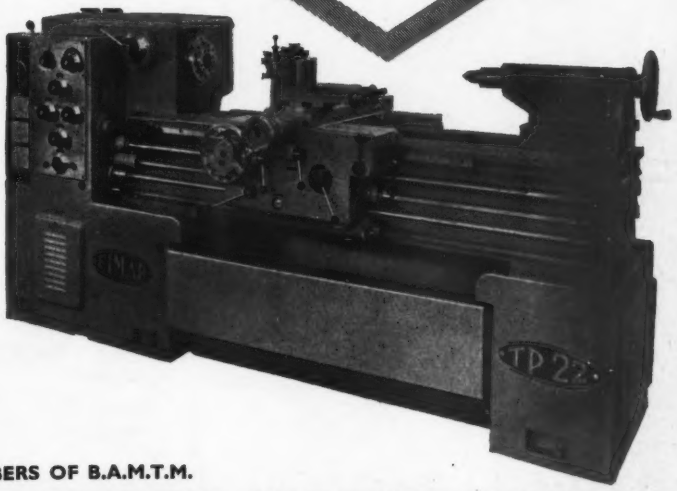

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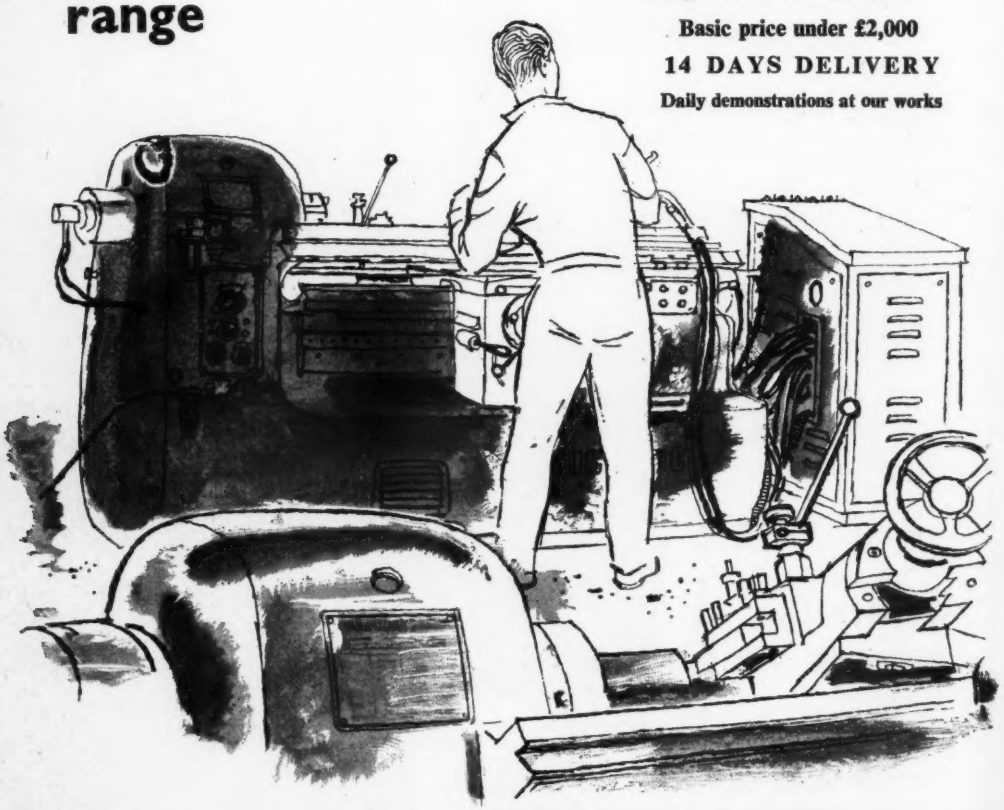

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Spindle:	Spindle Nose ..	No. 40 N.S.
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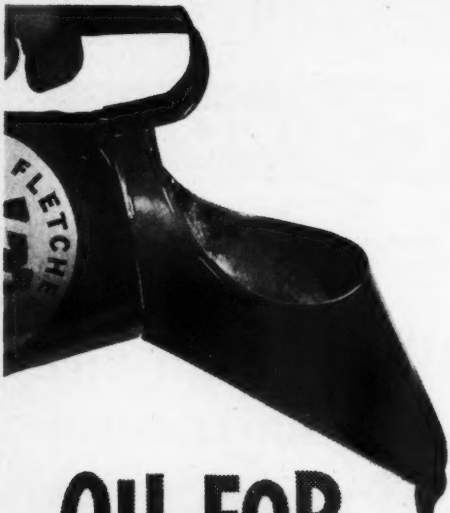

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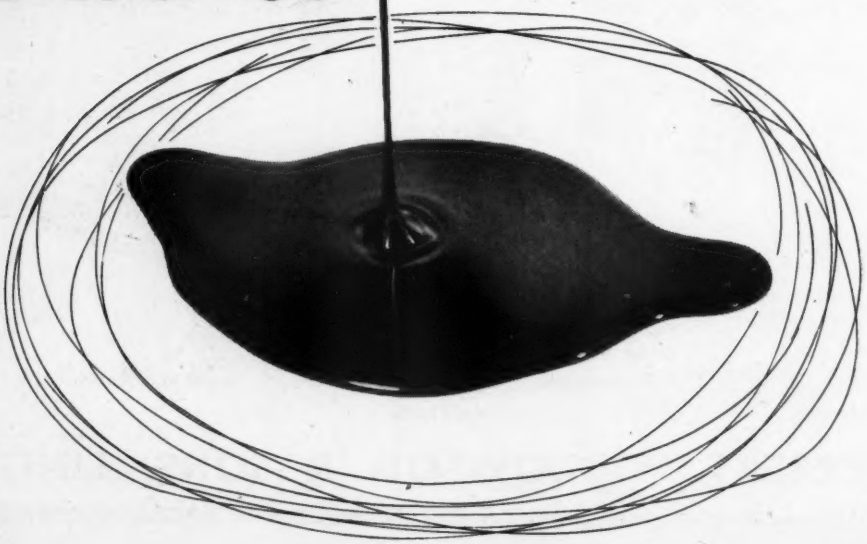

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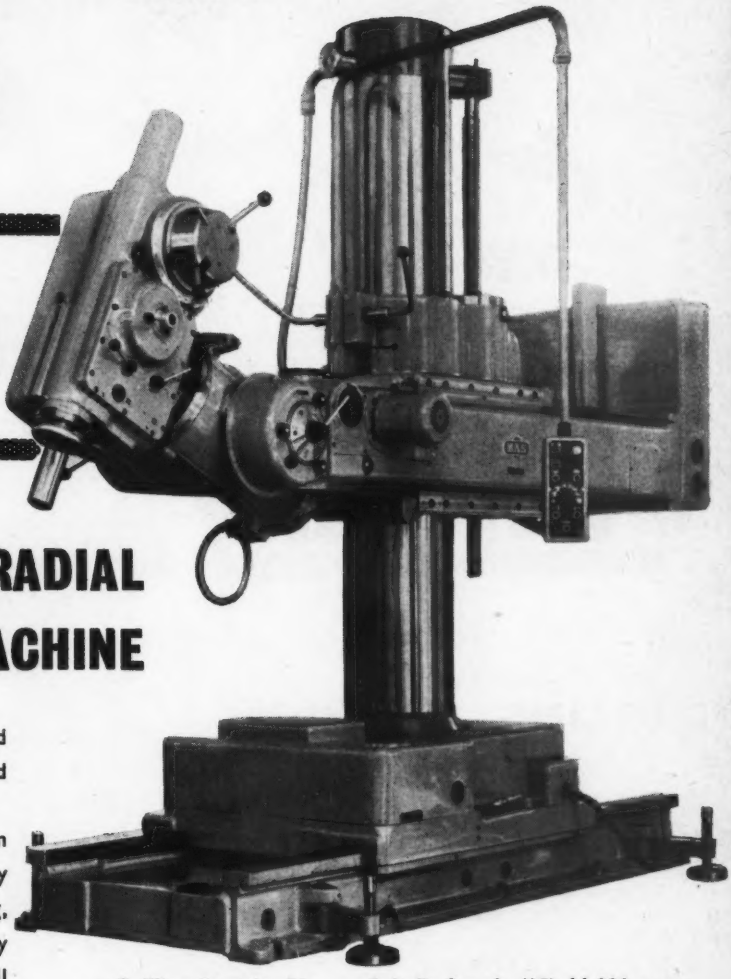

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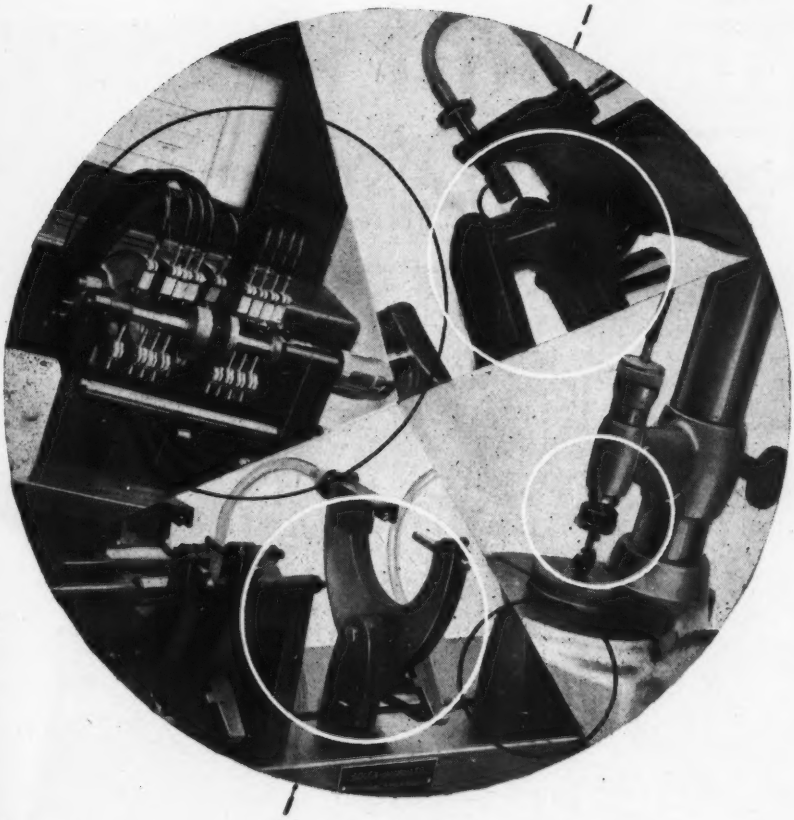

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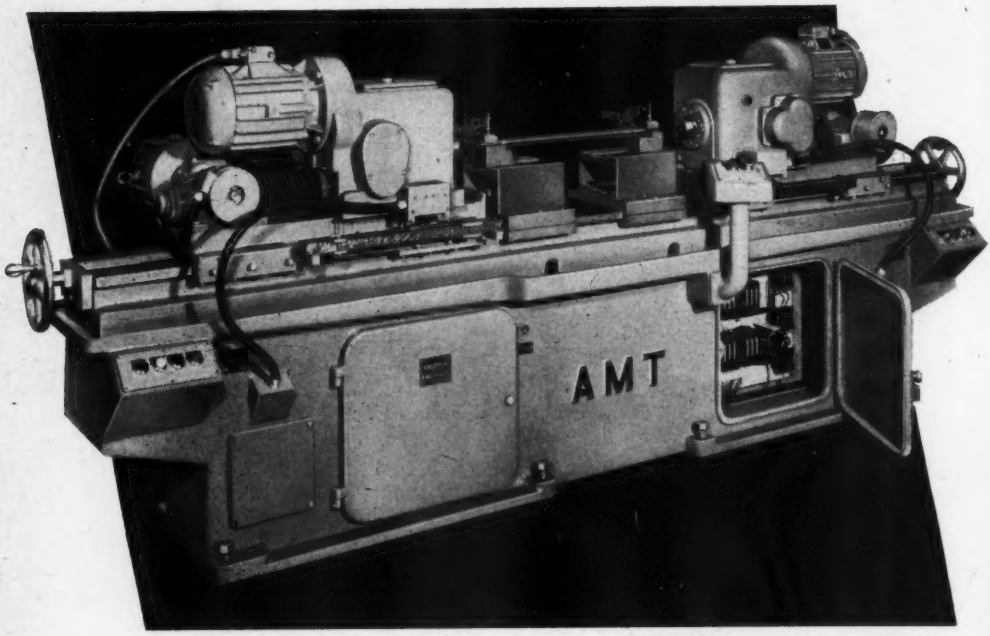

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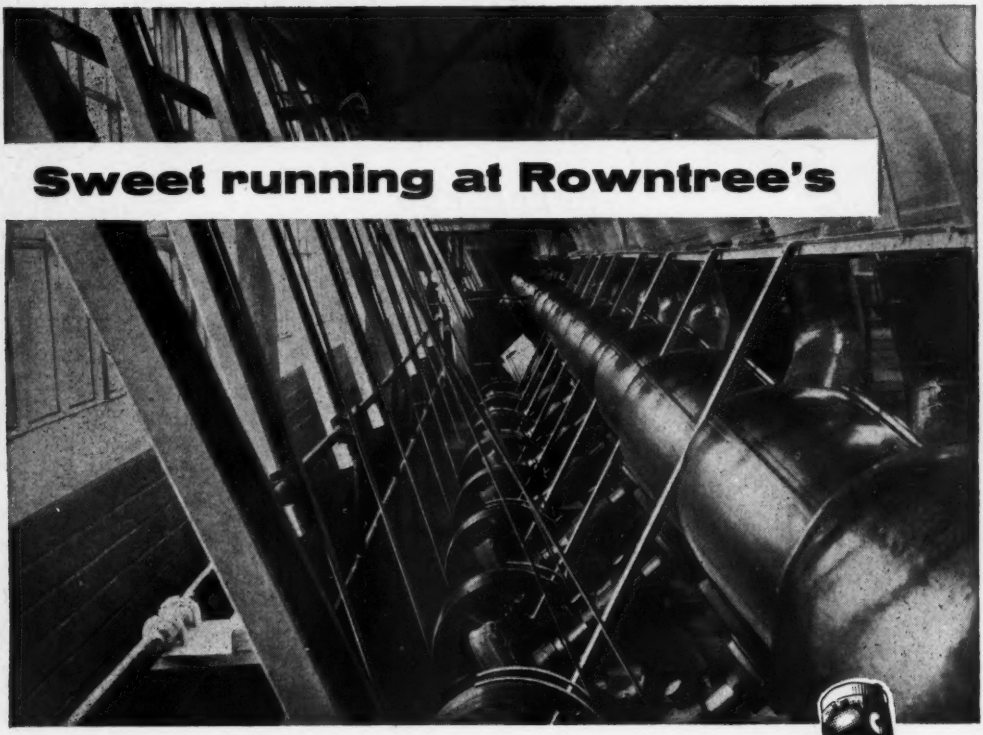

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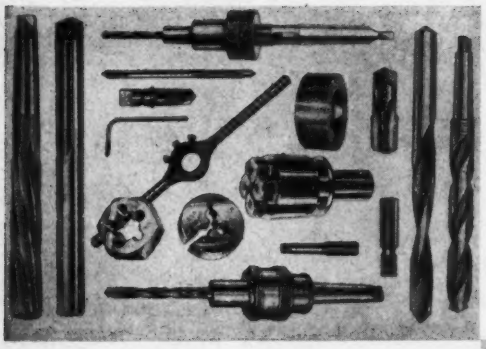

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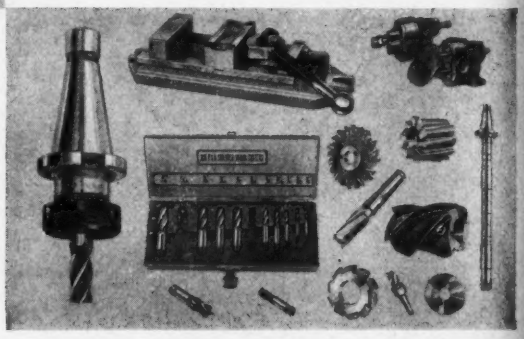

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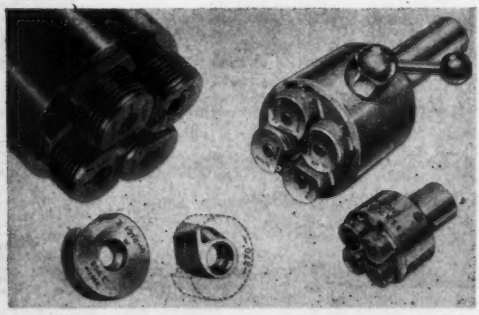

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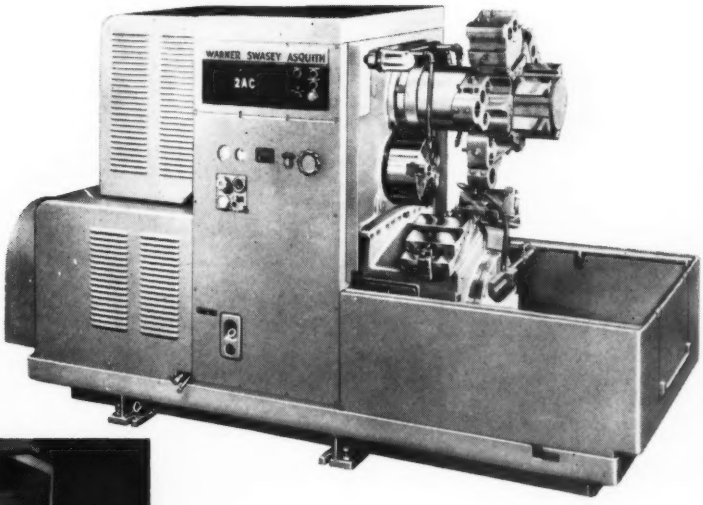

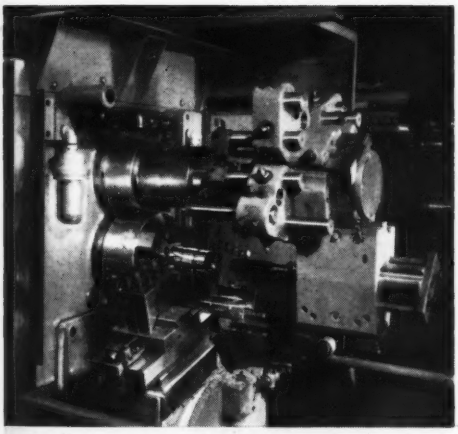

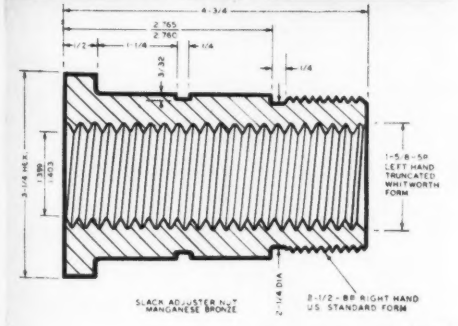

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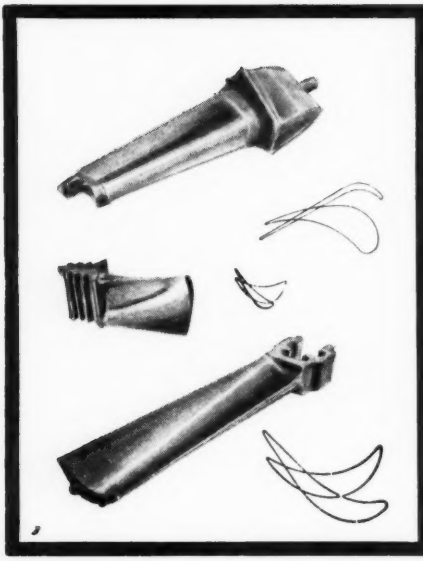

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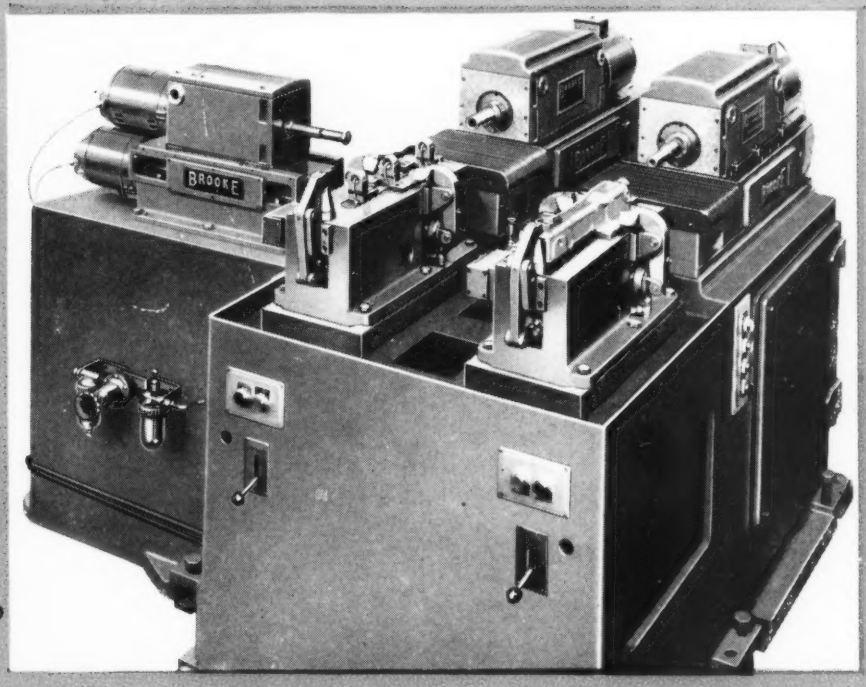

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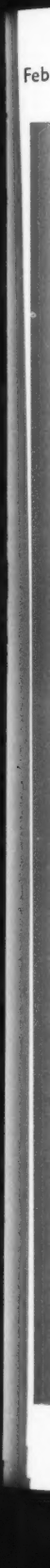

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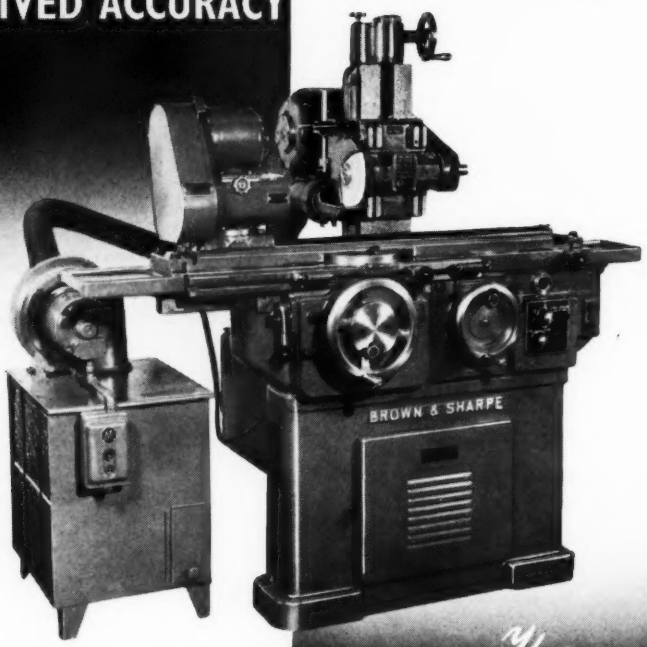

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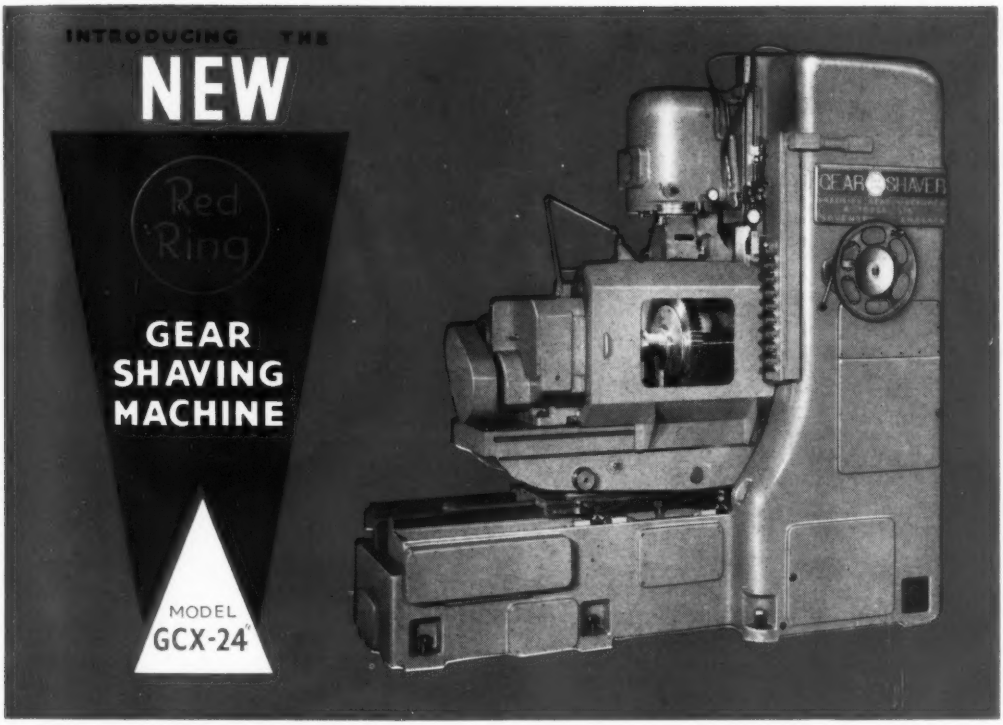

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All the advantages of the column-type shaving machine are retained in the new tunnel design without in any way restricting the method of vertical loading and unloading—an important consideration in handling heavy work units.

The work is loaded with the table at the extreme limit of its travel—clear of any overhead interference.

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SPECIFICATION

WORK SIZE Pitch Dia., 3in. to 24in. Outside Dia., 25.5in. max. Diametral Pitch, 2 to 16. Length Between Centres, 36.5in. max.

TABLE STROKE With Crowning, 4in. each side of centre. Without Crowning, 5in. each side of centre.

CUTTER SIZE Pitch Dia., 12in.

CENTRE DISTANCE Cutter to Work, 5in. to 19.5in.

OVERALL SIZE 100.5in. Wide × 46in. Deep × 98.25in. High.

WEIGHT 15,800 lbs.

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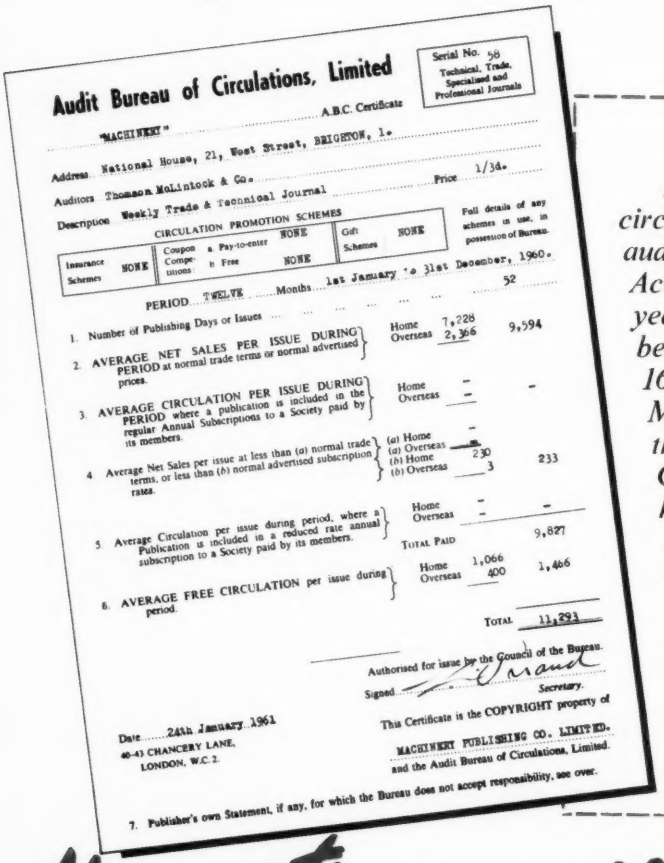

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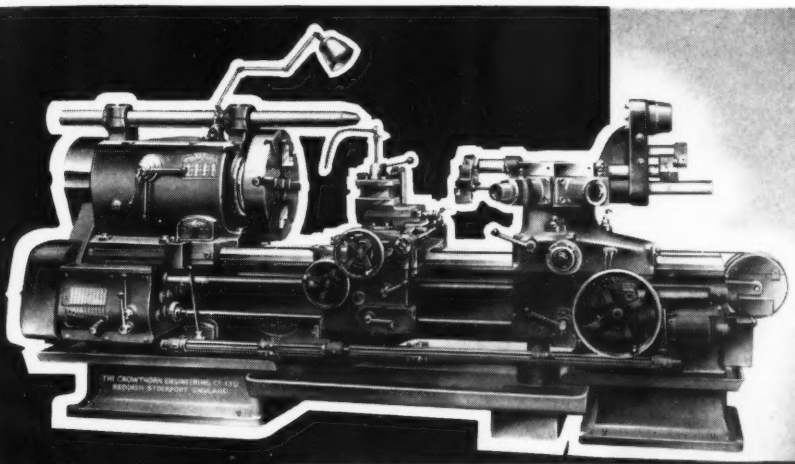

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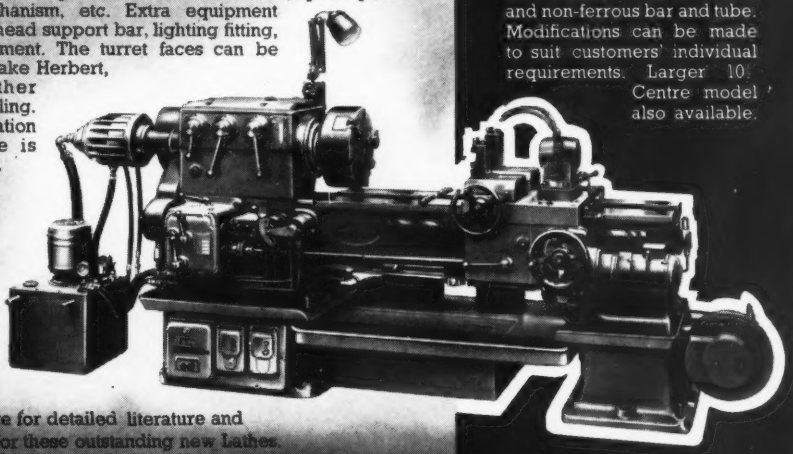

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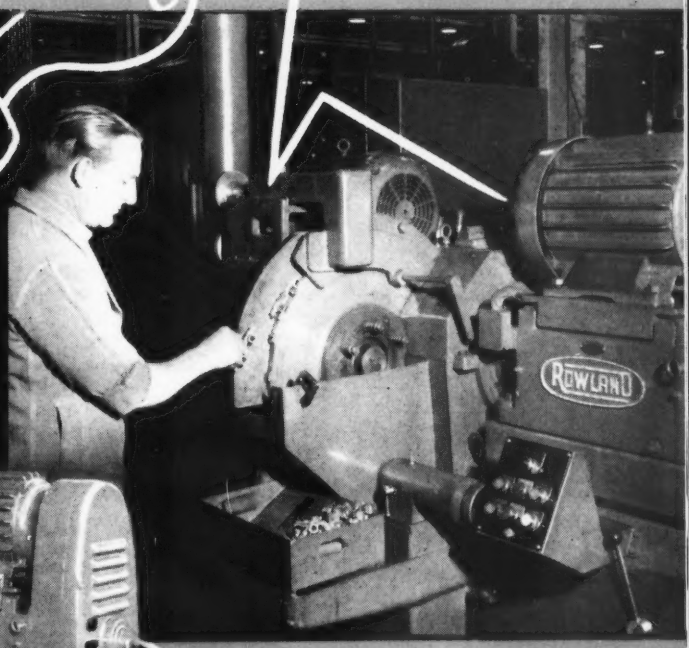

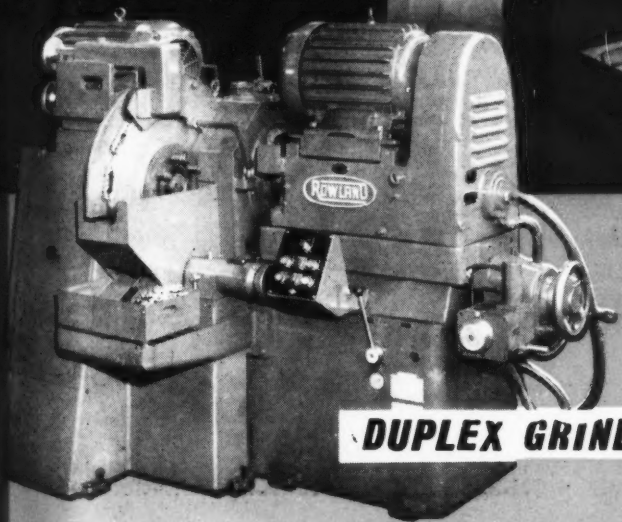

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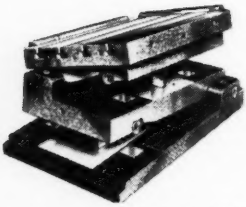
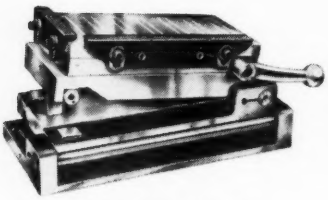
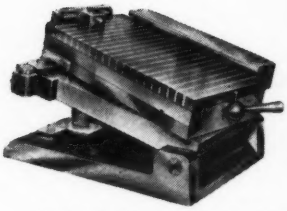


Compound Sine Table with 'T' Slotted Face: 12in. by 8in.



Compound Sine Table with Non-Electric Magnetic Face: 10in. by 5in.



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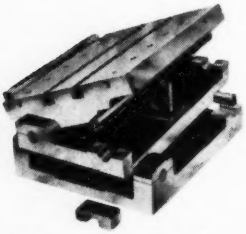

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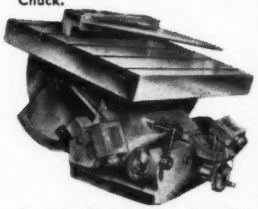

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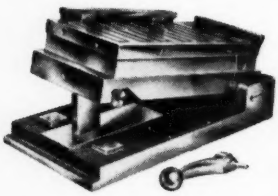
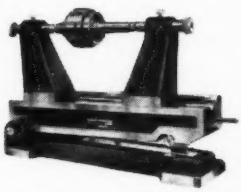


Simple Angle Sine Table with Non-Electric Magnetic Face: 10in. by 5in.



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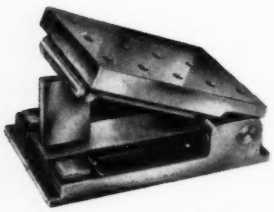

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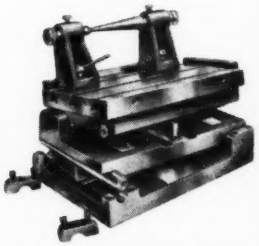
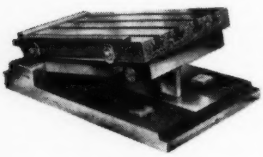


Universal Compound Sine Table with 'T' Slotted Face: 11in. by 7in.



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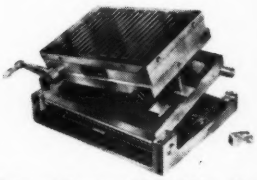

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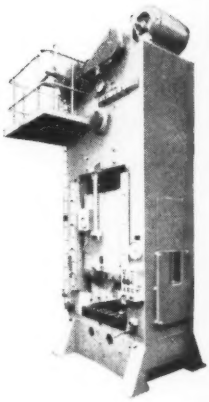

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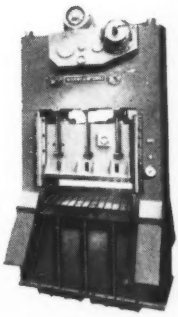

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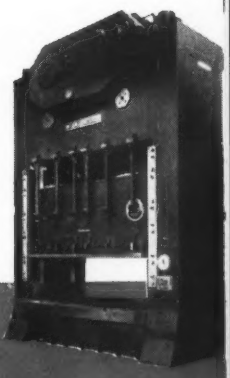

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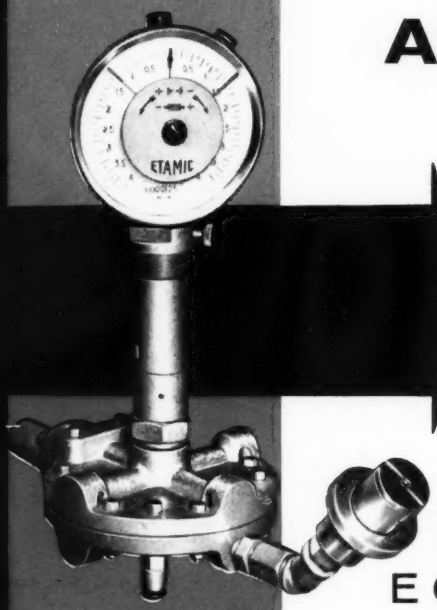

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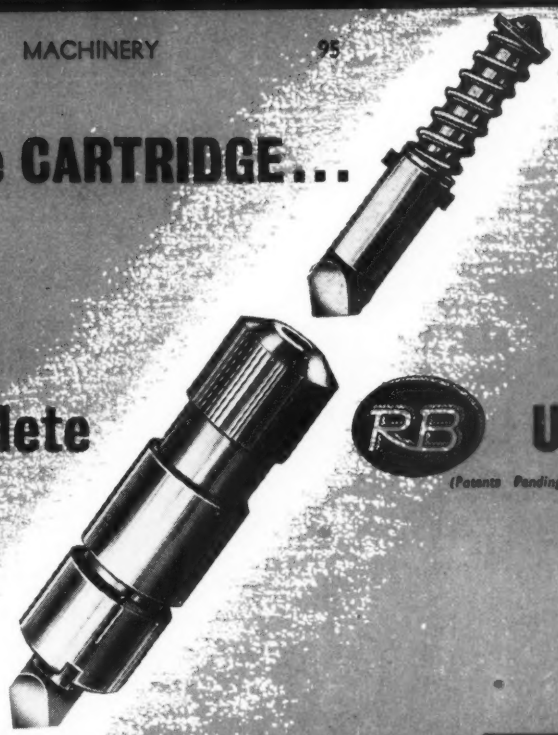

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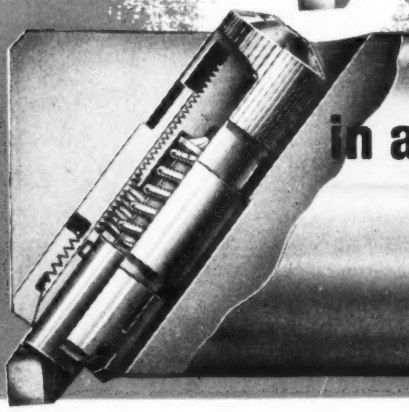

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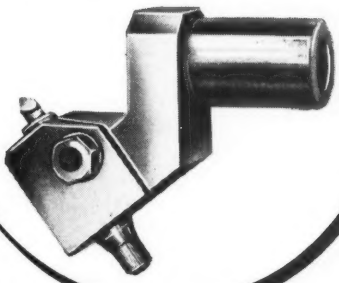

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Tool slides are rotated to the upward position so tools can be seen, reached and replaced easily.

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New Transfer-matic Combines Chucking with Drilling, Broaching and Assembly

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This Transfer-matic starts with rough castings and completely finishes wheel hubs ready for final assembly. Operations consist of turning, boring, facing, drilling, broaching, and assembly of studs. Capacity at 100% efficiency is 200 parts per hour.

New Cross building blocks for chucking operations make this combination of work possible. Like other Cross building blocks, they can be rearranged as requirements change.

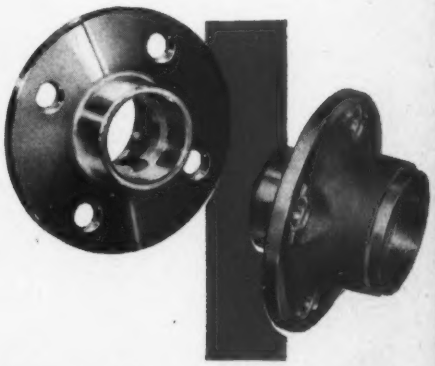
Advantages of the new Transfer-matic include maximum accuracy and uniformity, higher output, less handling, and faster production than conventional methods.

Heavy duty, three jaw chucks are used on the roughing operations but diaphragm types are employed for finishing to avoid clamping distortion.

A work bank between Sections I and II permits independent operation of either one during maintenance.

The new building blocks include a novel slide unit which tilts the tools upward to speed changes.

Cross engineers will gladly discuss details of this Transfer-matic with you.



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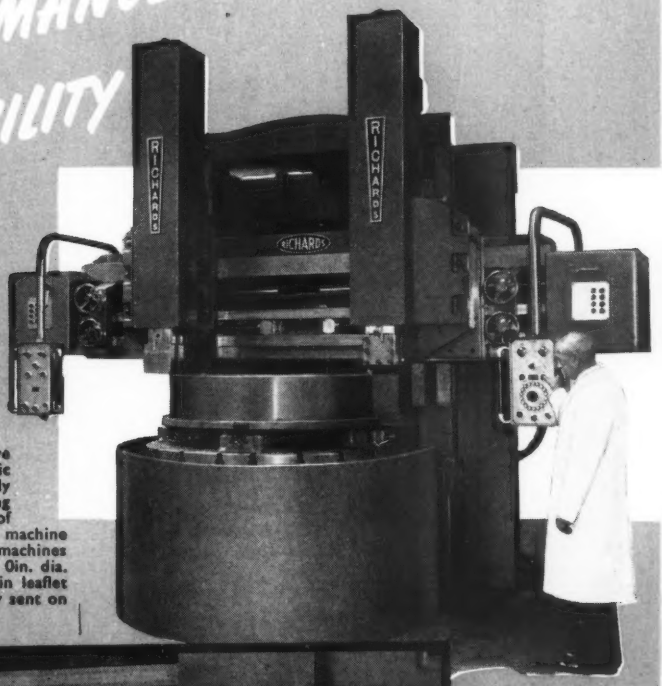

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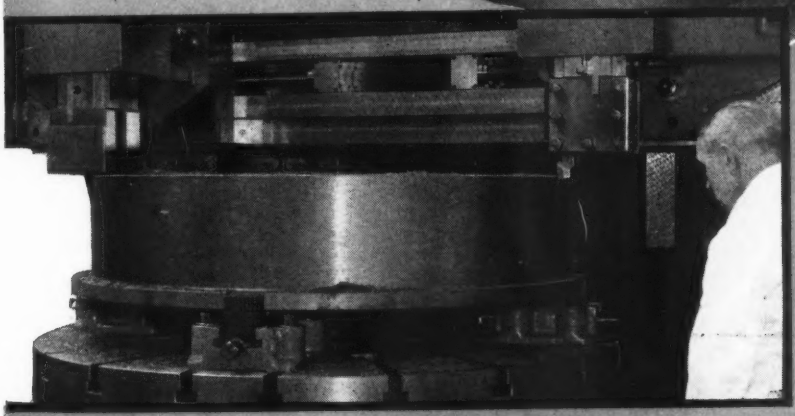

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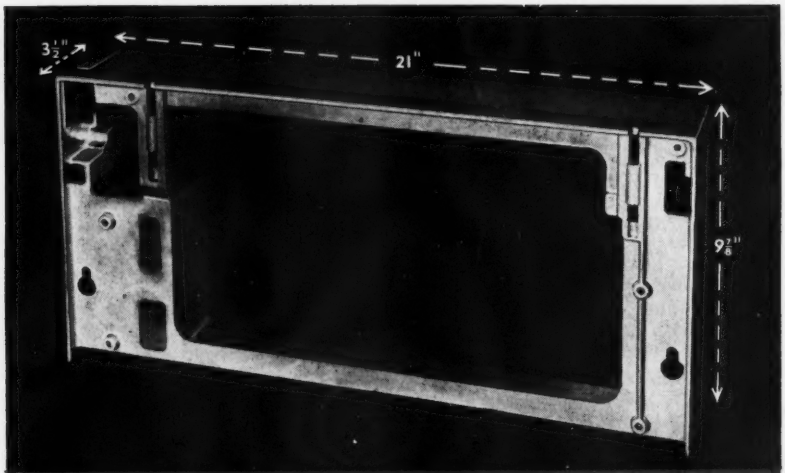

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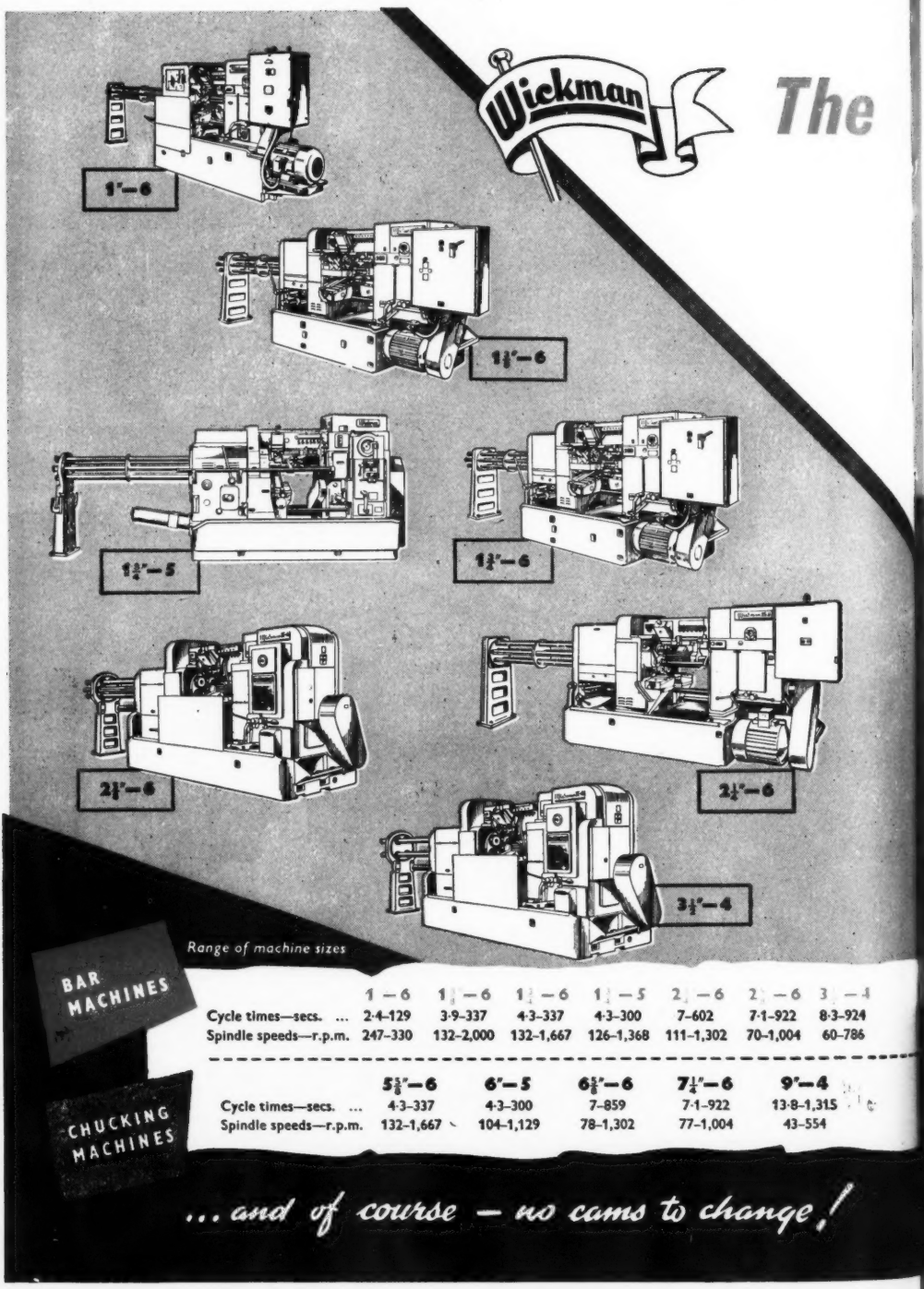
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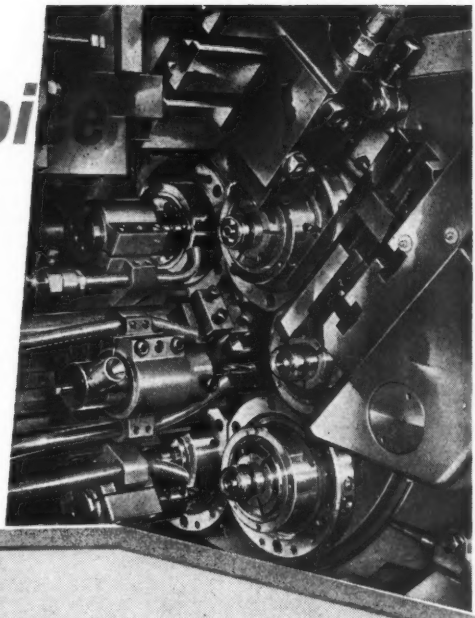

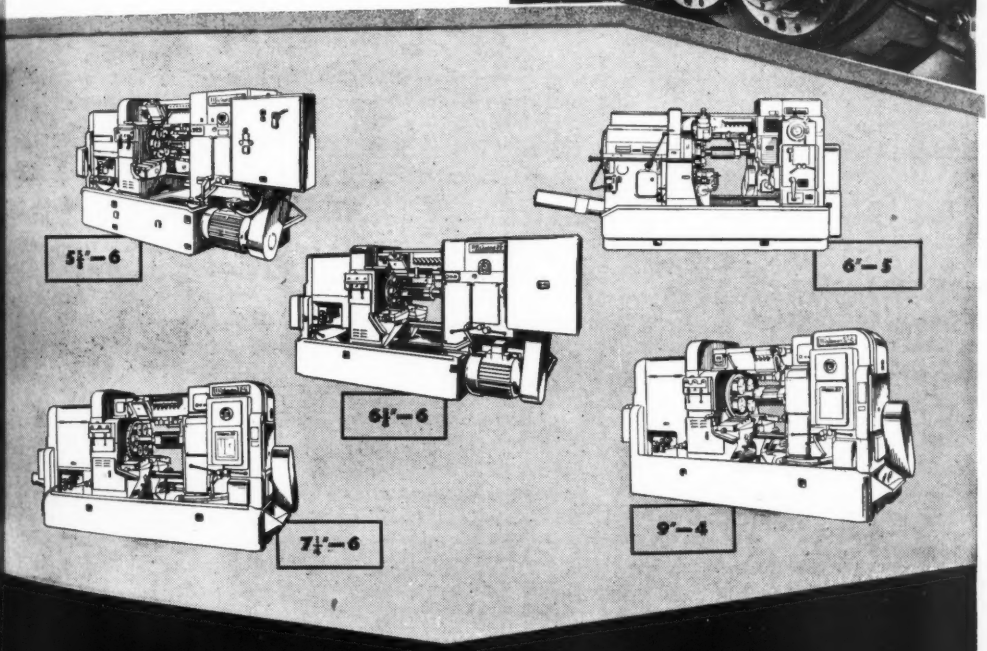

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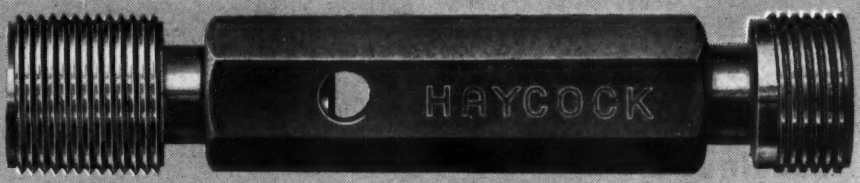

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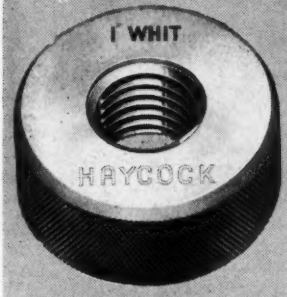

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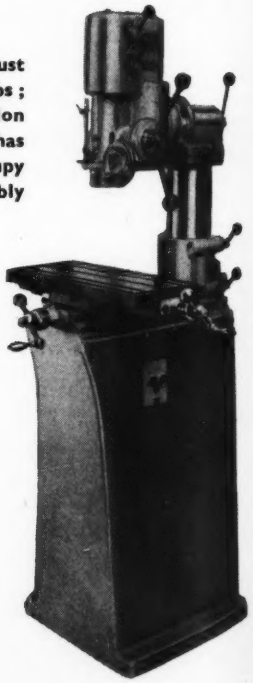

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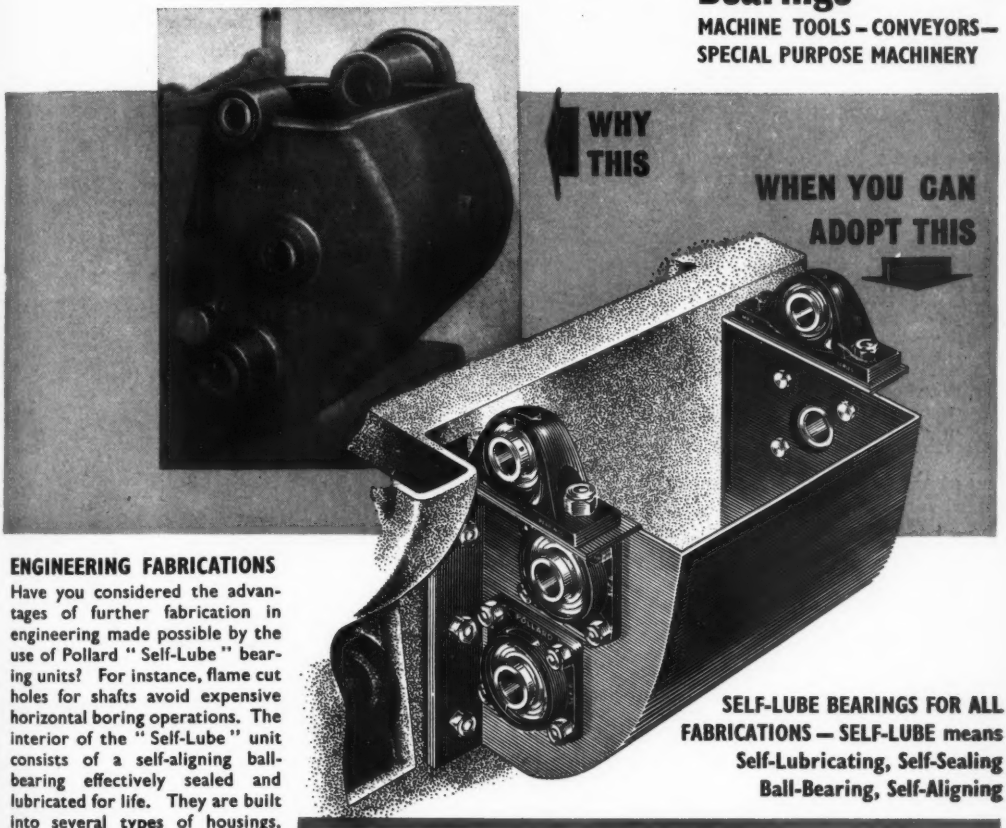

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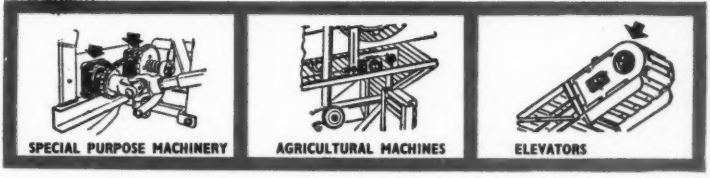

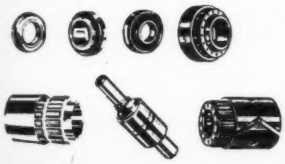

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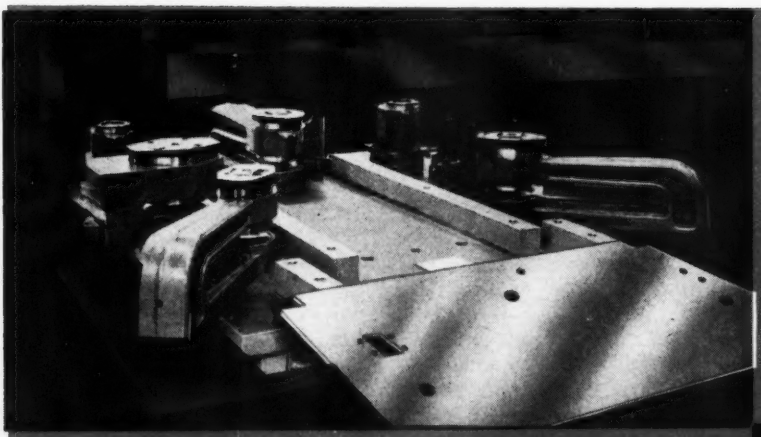

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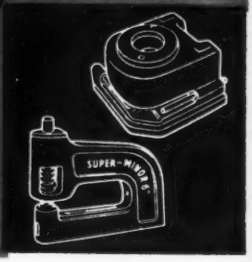

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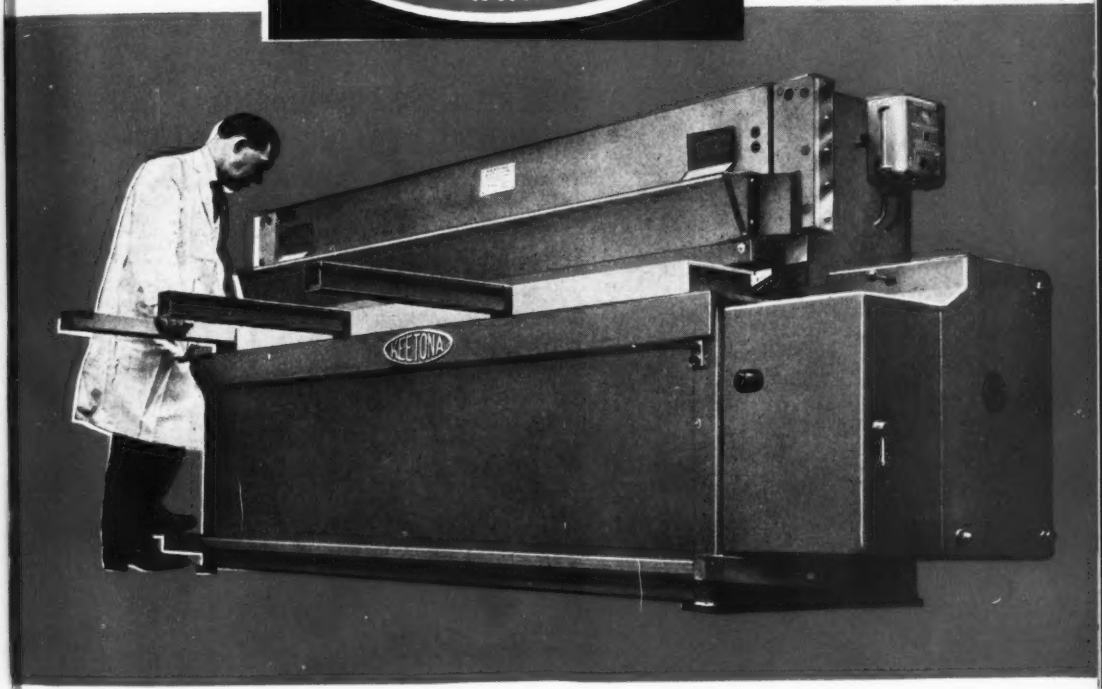

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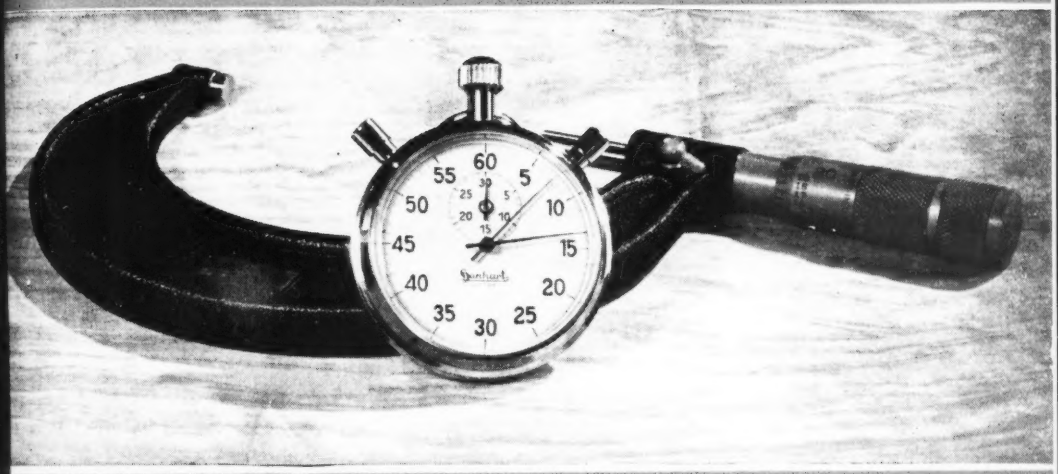

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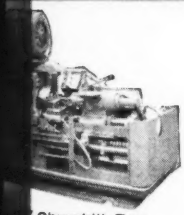

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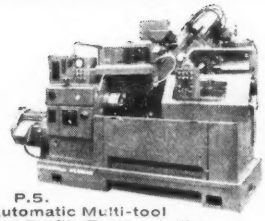

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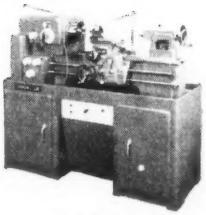

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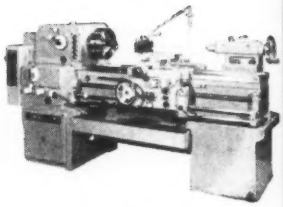

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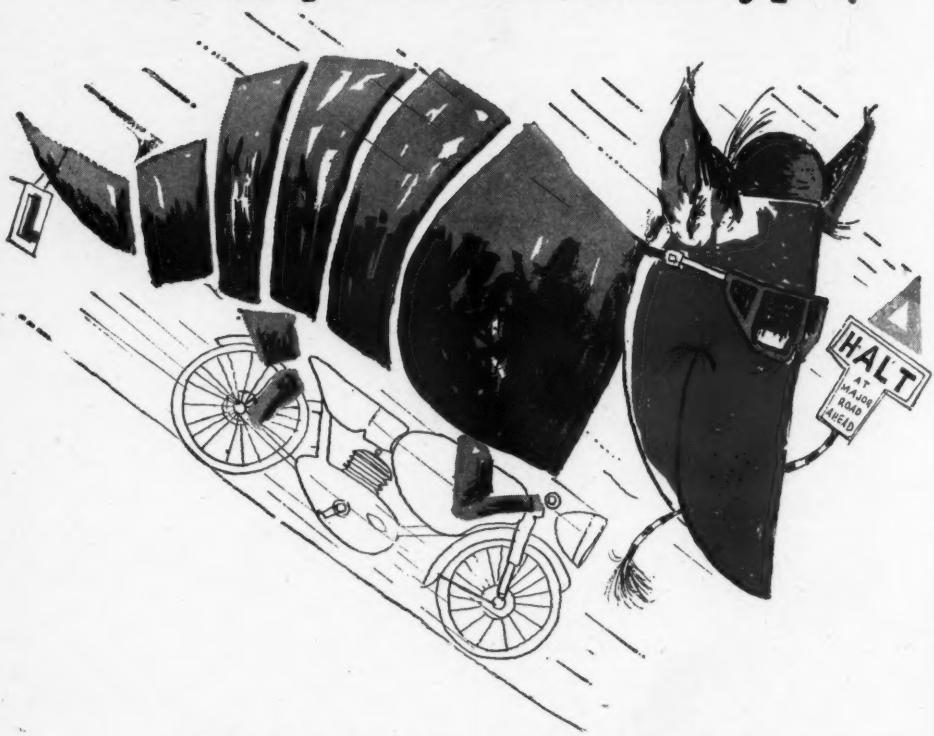

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Vol. 98, No. 2519 February 22, 1961

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Abstracts of Principal Articles

Japanese Machine Tool Factories .. P. 408

This article is the fifth of a series on Japanese machine tool factories, and is concerned with the works of the Mitsui Precision Machinery & Engineering Co., Ltd., Tokyo. Brief reference is first made to the history of the company, and attention is then drawn to some of the plant installed in the works and certain of the methods employed. Jig borers are used extensively for machining castings, and scraping operations are performed in a room which is maintained at a temperature of 68 deg. F. Two machines from the range of four jig borers now being produced are briefly described, and attention is drawn to a prototype machine, developed in co-operation with other companies and Government Departments, for jig boring under punched tape control. Mention is also made of the firm's range of five cylindrical grinding machines, and of machines constructed with Renault unit heads. (MACHINERY, 98—22/2/61.)

Telecontrol Communication and Recording System in a Bearing Factory .. P. 418

Intermittent and unpredictable short-period interruptions in production were found to be causing, collectively, considerable losses at the bearing plant of the Hoover Ball & Bearing Co., Ann Arbor, Mich., U.S.A. This article describes how the reasons for inefficient utilization of machine tools and other production equipment were detected, analysed, and subsequently controlled and reduced, by the installation of the Telecontrol communication and recording system. With this equipment, the productive and idle times of all machine tools are continuously monitored automatically in a central control room, and operators are provided with facilities for summoning assistance, or calling for fresh supplies of raw material, for example, without the need for leaving their machines. (MACHINERY, 98—22/2/61.)

The Lamalock Hydraulic Pressure-unit System .. .. P. 423

The Lamalock hydraulic pressure-unit system, developed and patented by A. E. Sykes, 5 Harrison Street, Leicester, is based on the use of small sealed "capsules," termed "lamellae," which enable hydraulic pressure to be converted to mechanical pressure with high efficiency. This principle is employed in the J. & S.-Lamalock collet chuck, which has high gripping power, and the J. & S.-Lamalock adapter plate for use on magnetic chucks. A further development is a tapping chuck, in which the slipping torque can be pre-set, with considerable accuracy. Other applications discussed are concerned with self-adjusting jacks, for supporting "awkwardly"-shaped components during machining, automatic controlled-clearance plain bearings, and clutches. (MACHINERY, 98—22/2/61.)

Ortlinghaus Multi-disc Clutches .. P. 431

In recent years, the German firm of Ortlinghaus-Werke has concentrated on the development of various types of multi-disc clutches for machine tool applications. A range of electro-magnetic, hydraulic, and pneumatic units is now available, with a choice of metallic and non-metallic frictional materials for the discs. A feature of the design is the use of Sinus corrugated discs interspersed with flat plates, and with this arrangement effective separation of the discs is ensured, when the clutch is disengaged. (MACHINERY, 98—22/2/61.)

Production of Bolt-head Trimming Dies by Intraforming .. .. P. 435

One of the first of the Intraforming machines, which have recently been introduced by the Meta-Dynamics Division of the Cincinnati Milling Machine Co., U.S.A., has been installed in the works of the Howell Gear Co., Mich. Details are given of the use of the equipment to make trimming dies for bolt heads, splined sleeve couplings, and components with assymetrical internal cross-sections. (MACHINERY, 98—22/2/61.)

Gravity and Pressure Die Casting at the Works of Thomas Ashworth & Co., Ltd., Burnley .. .. P. 439

In this article, which is the second of two, attention is drawn to some aspects of the works practice of Thomas Ashworth & Co., Ltd., in their new factory. Core-pulling cylinders of the company's own design and construction are used and can be interchanged between dies. Examples of dies for the pressure casting of components for surveying instrument and radar components, also for washing machines, from aluminium, are described. Gravity die casting of aluminium alloys is also carried out, and dies for the production of washing machine tops, and a tapered tubular pedestal with a box-shaped end, are considered. Equipment for clipping pressure die castings includes a platen-type press of 30 tons capacity. (MACHINERY, 98—22/2/61.)

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

Standardization of Tooling Areas on Machines

In the Mitchell report on the machine tool industry, published in November of last year, it was advocated that greater attention should be paid to the standardization of those parts of machines which are of primary importance to users, "particularly those features associated with the attachment and location of workpieces, tooling, and ancillary equipment." The committee responsible for the preparation of the report went on to explain that they had especially in mind such aspects of design as table sizes and pitch of T-slots on milling machines, spindle centre heights on certain types of boring machines, and "tool holder attachments and jig and fixture attachments of all kinds" for standard machine tools.

An instance, recently brought to our attention, indicates how the machine tool user may be assisted by a very small measure of standardization on the part of the builder, which certainly could not be said to impose any undue restriction on the designer of the machine. Some milling machines of a well-known Continental make were purchased by a British company, and it was decided that whereas batch quantities of the various workpieces to be machined were not sufficient to justify duplication of fixtures for orthodox pendulum milling, this method could nevertheless be applied with advantage, by mounting fixtures for different components at opposite ends of the table and providing a suitable composite cutter gang on the arbor. When it was required to transfer the tooling to a different machine, despite the care that had been taken in the design and construction of the fixtures, and the spacing of the cutters on the arbor, unexpected difficulty was experienced in obtaining the required alignment between the cutters and the respective workpieces. In seeking an explanation, it was found that whereas the table T-slots were of consistently accurate width, the spacing of the slots differed as between one machine and another.

When this matter was brought to the attention of the makers of the machines, we understand, they at once appreciated the advantages that would accrue in such circumstances from accuracy and consistency of slot spacing, and decided that in future such spacing would be standardized. Clearly it will be of considerable benefit to users if they are able readily to interchange fixtures between one machine and another of the same make, but the convenience would be proportionately greater if interchangeability were also possible between machines of different makes but of the same general capacity.

In connection with this problem, it has been pointed out by the Users Standardization Group on General Purpose Machine Tools in the U.S.A. that in recent years there has been a trend in industry towards more frequent changes in product design. At the same time it has become increasingly common practice to machine parts for products of the latest designs in so-called "production areas" and to relegate the machining of components for older products, or for replacement purposes, to "service areas" which may be situated some distance away. When it is also considered that production requirements may fluctuate considerably, with the consequent desirability for fairly frequent transfers of work from one machine to another, it can readily be appreciated that lack of interchangeability can result in the "premature obsolescence of many expensive tools and fixtures." It is emphasized that the programme of standardization which is proposed for the purpose of correcting this situation "will not influence the design features peculiar to each machine tool builder's product, neither will it inhibit nor restrict creative design developments for future requirements."

As an indication of the "areas recommended for standardization," horizontal, knee-type, plain and universal milling machines may be considered by way of example. For such a machine, it is advocated, there should be standard minimum and maximum distances from the spindle centre to the table surface; minimum length and width of working surface; maximum and minimum distances from the table centre line to the column face; and a minimum horizontal table travel. In addition, the inside diameter of the arbor support bearings should be standardized, also the number, spacing, and size of the T-slots in the table working surface, and those provided at the front edge for the reception of trip dogs.

The Mitchell committee recommended that the machine tool industry should set up an effective organization for the purpose of achieving greater standardization in the directions here discussed. Such an organization, it was pointed out, should act in close consultation with users, and, where appropriate, with the British Standards Institution.

(*Continued on page* 463)

Japanese Machine Tool Factories*—5

Mitsui Precision Machinery & Engineering Co., Ltd., Tokyo

By R. E. GREEN, Associate Editor

PRIOR TO DECEMBER, 1928, when the Mitsui Precision Machinery & Engineering Co., Ltd., was formed, all precision machine tools such as jig borers, required in Japan, had to be imported. Building of small precision machines, also the manufacture of high-pressure air compressors and various types of war equipment, were well established by the time the company moved in 1934 to the site of the present main factory, known as Tokyo Works, at 303 Shimomaruko-machi, Ota-ku, Tokyo. The business continued to develop, and in 1941 another factory was started at Okegawa, in Satama Prefecture, at which the production of machine tools was concentrated, Tokyo Works having been changed over to the manufacture of torpedoes.

In 1943, two other factories were started, for the manufacture of measuring instruments, at Seta and Numazu. After the war, the Numazu works were abandoned, having been completely destroyed, and other factories were operated on a much smaller scale than during the war years. In 1949, the Seta works were closed, but there was steady progress at the two remaining factories. To-day, the Okegawa works are devoted to the production of 3-wheeled commercial vehicles. These vehicles are widely used in Japan because of their low fuel consumption and running costs, and are usually grossly overloaded. They are made in "small", 1-ton and 2-ton sizes, and some 1,000 people are employed in their manufacture.

TOKYO WORKS OF MITSUI

The Tokyo works of the company cover an area of some 363,000 sq. ft., and are situated on the outskirts of the city. About 700 people are employed, including those in the sales and admini-

* Articles on the Japanese metal-working industries which have already been published in MACHINERY have been concerned with the 4th Osaka International Trade Fair, 96/1212—1/6/60 and 96/1288—8/6/60; Motor Car Production in Japan, 96/1426—15/6/60, 96/1552—22/6/60 and 96/1640—29/6/60; Bicycle Production in Japan, 97/46—6/7/60; Refrigerator Production in Japan, 97/416—24/8/60 and 98/176—25/1/61; Electric Motor Production in Japan, 97/708—28/9/60, 97/1276—7/12/60 and 97/1448—28/12/60; Television Receiver Production in Japan, 97/932—26/10/60; and Transistor Production in Japan, 98/253—1/2/61; The Machine Tool Industry of Japan, 97/108—13/7/60; Japanese Machine Tool Factories, 1. Ikegai Iron Works, Ltd., 97/304—10/8/60, 2. Okuma Machinery Works, Ltd., 97/472—31/8/60, 3. Toyoda Machine Works, Ltd., 97/652—21/9/60, 4. The Kawasaki Works of Hitachi, Ltd., 97/1048—9/11/60.

strative departments, and in addition to jig borers, the company produces a range of cylindrical grinding machines in five sizes, including one of universal type. Production of jig borers was started in 1933 with a simple machine, on which vernier scales were employed for setting, no optical equipment being provided. The range now comprises four sizes, and additional—larger—machines are shortly to be introduced. Measuring instruments, including gauge blocks, and air compressors are still made at the Tokyo works, and in 1957 the company concluded a technical assistance agreement with the French Renault company, whereby unit heads and other transfer machine elements are built under licence.

Because of the small numbers in which jig boring machines are built, very little use is made of jigs or fixtures in the works, most of the larger components being produced almost entirely on precision machines, including jig-borers, which are installed in a temperature-controlled section of the factory. These machines include a Gould & Eberhardt (Drummond-Asquith, Ltd.) hobbing machine for the production of worm wheels up to 1 metre (39·37 in.) diameter, also three of the largest (No. 6) Mitsui jig borers and one No. 3 machine. The section also houses the Dixi (Dowding & Doll, Ltd.) horizontal precision boring machine, shown in Fig. 1 set up for operations on a gearbox for the table screw of the No. 3 size Mitsui jig borer.

This casting is held on a rotary table, arranged for optical setting, which is mounted in a vertical position, on a machined face at one side, on top of the normal rotary table of the Dixi machine. This second rotary table is also arranged for optical setting and the arrangement enables four bores to be machined in the casting without reclamping.

In the grinding department there is a number of machines from Western countries, including some by Fortuna-Werke (Vaughan Associates, Ltd.), Norton (Alfred Herbert, Ltd.) and Schaudt (Burton Griffiths & Co., Ltd.), also Japanese-built machines by Okuma Machinery Works, Ltd. For grinding hardened gears to be used in jig borers, the Reishauer (Dowding & Doll, Ltd.) machine seen in Fig. 2 is employed. This machine is shown set up for grinding two spur gears for a Renault unit head, with 44 teeth, a pitch diameter of 77 mm. (3·0315 in.), and a face width of 22 mm. (0·866 in.). There is also a large Mattison (Gaston E. Marbaix, Ltd.) surface grinding machine, with a table length of about 13 ft. which is employed for finishing flat surfaces on various parts, also for guideways on certain components.

Traversing screws for jig borers and grinding machines are produced on lathes built or adapted for the purpose by the company, and where a high degree of accuracy is required, they are finished on the Matrix (Rockwell Machine Tool Co., Ltd.) thread grinder shown in Fig. 3, which has a capacity of 6 ft. between centres. The machine is installed in a temperature-controlled room, with several other precision grinders, and is enclosed with sheet metal and plastics covers while in operation. These covers confine the mist generated by the grinding operation, and prevent it from being circulated through the air-conditioning unit.

Temperature control is also provided in the shop

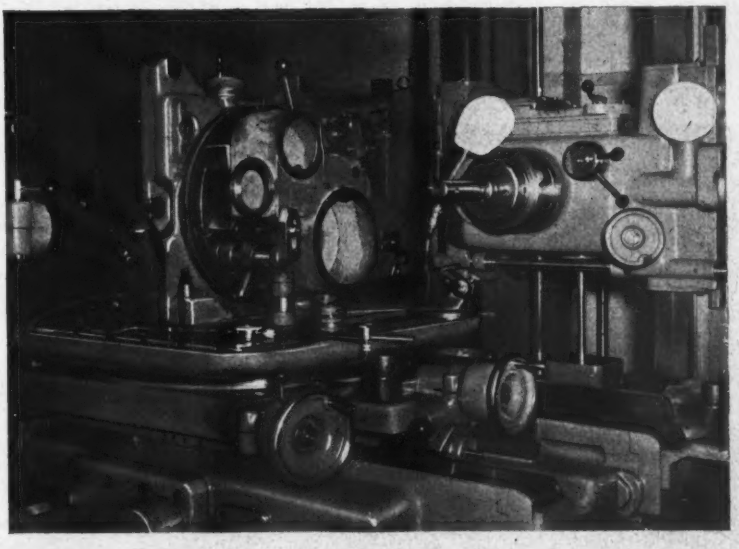

Fig. 1. At this set-up, on a Dixi horizontal precision boring machine, installed in the air-conditioned jig boring room at the Tokyo Works of Mitsui, operations on four bores in a table screw drive gearbox for a jig borer are completed at one setting of the work

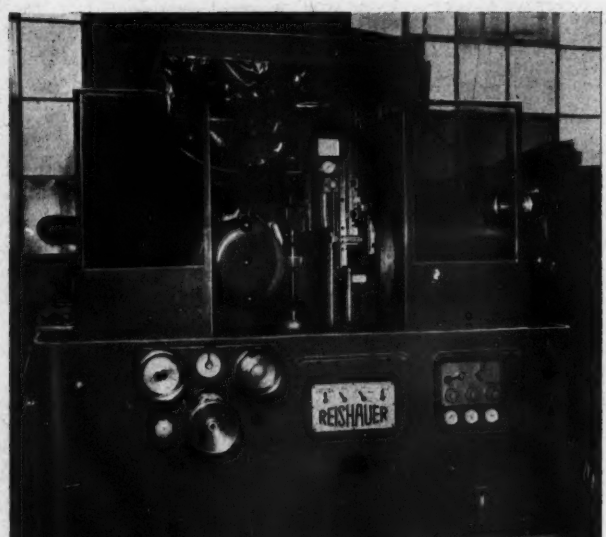

Fig. 2. This Reishauer gear grinding machine is employed for finishing operations on hardened precision gears. It is seen set up for finishing two spur gears for a Renault unit head

where guideway scraping operations are carried out, and in the general view in Fig. 4, the ducting through which conditioned air is continuously supplied may be seen on the wall at the right. The installation is designed to maintain the temperature in the room continuously at 20 deg. C. (68 deg. F.). It also ensures that the pressure is slightly above atmospheric, to prevent the ingress of air-borne dust. The three beds at the right in Fig. 4 are for grinding machines, and those at the left are for No. 3 size jig borers.

Other plant installed in the factory includes a total of eight planing machines, one of which, by Gray (Gaston E. Marbaix, Ltd.), is shown in Fig. 5. This planer has a capacity for work up to about 9 ft. 10 in. long by 3 ft. 3 in. square, and is the smaller of two machines by this maker. The workpieces seen on the table are Meehanite iron bed castings for the No. 0 Mitsui jig borer, on which vee and flat guiding surfaces for the table are being machined. Another Gray planer with a table width of 8 ft. 2½ in. is on order, and delivery is expected shortly. This machine is intended for operations on components for the No. 7 size jig borer, which is to go into production at an early date.

Although the output of jig boring machines is not large, the demand from the home market, partly as a result of the severe restrictions imposed on imports, is continuous, and a fairly full order book enables machines to be built in economical numbers. A view in the erection bay for jig borers, showing four of the No. 3 size machines under construction, is given in the heading illustration to this article.

One of the difficulties faced by the company, when the building of high precision machines was started, was due to the almost complete lack of

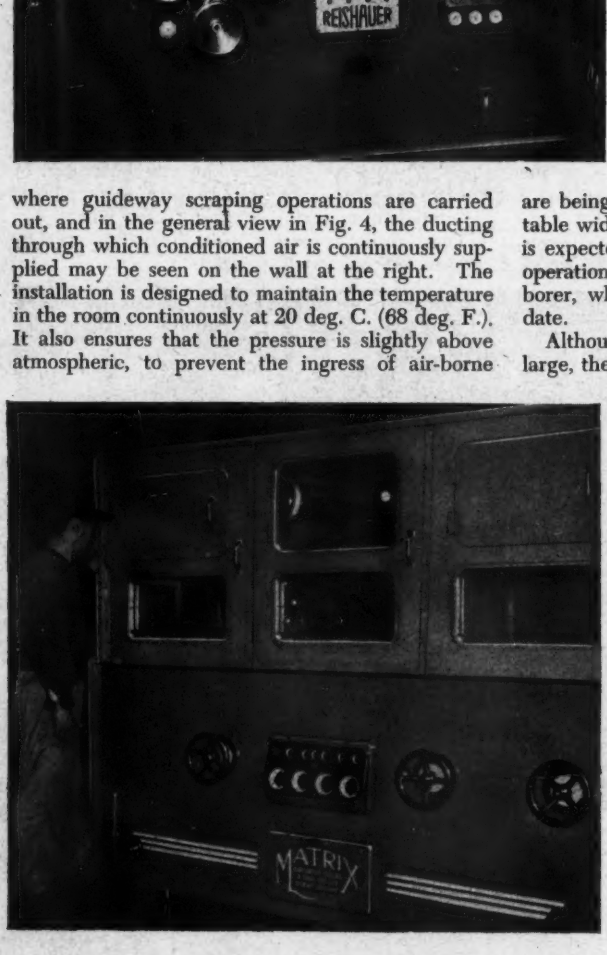

Fig. 3. The enclosure surrounding this Matrix thread-grinding machine, which is employed for finishing operations on precision lead screws, serves to confine the oil mist generated and prevent it from entering the air-conditioning system

Fig. 4. Scraping operations on castings are performed in this temperature-controlled room at the Mitsui works

experience of such work in the country, and the reluctance of Western companies to grant manufacturing licences or to share their experience. These problems have now been largely overcome, and most of the machines at present in production, although bearing superficial resemblances to those of other makes, are of original Japanese design.

Mitsui jig borers incorporate precision engraved scales made in England, by Hilger & Watts, Ltd., for table and spindle head setting, and some of the biggest problems, which have not yet been completely overcome, have been associated with the production of scales of the required degree of accuracy. Among the equipment at present installed in the dividing room was noted a Leitz optical dividing machine, employed for checking scales, and a Société Genevoise mechanical dividing machine. Another linear dividing machine, recently acquired, was supplied by the East German firm of VEB Feinmess, Dresden, and has an accuracy of 4 microns (0·00016 in.). At the present time, the company is working on the prototype of a new machine, of combined optical and electronic type, with a light interference system, for engraving scales to an accuracy of 1 micron (0·00004 in.).

The dividing room also contains a Taylor, Taylor & Hobson, Talysurf type 3 surface finish measuring

Fig. 5. The Gray planer, here illustrated, is the smaller of two machines by this maker which are installed in the works, and has a capacity for castings up to 9 ft. 10 in. long by 3 ft. 3 in. square. It is shown set up for operations on Meehanite bed castings for the No. 0 jig borer

machine, projectors by Zeiss (Degenhardt & Co., Ltd.) and Mitsui, vibration testing equipment, and a Zeiss interferometer for checking gauge blocks.

PRODUCTS OF THE MITSUI TOKYO WORKS

As stated earlier, Mitsui jig borers are made in four sizes, and the No. 0 machine, which is the smallest, was described in MACHINERY, 96/1218—1/6/60, in the first of two articles concerned with the machine tools exhibited at the Osaka International Trade Fair last year. The No. 1 machine, which is shown in Fig. 6, has a table with a working area of 450 by 270 mm. (17·7 by 10·63 in.). Longitudinal and transverse movements of the table are 200 and 300 mm. (7·87 and 11·8 in.), and the spindle head has a vertical traverse of 250 mm. (9·84 in.). The spindle has a travel of 80 mm. (3·15 in.). It is driven from a motor of 0·5/0·33 h.p., and there is a choice of eight speeds, from 280 to 3,000 r.p.m.

Standard scales from the Hilger & Watts range, of 56 per cent nickel-chromium alloy, and of channel shape with the 1-mm. division lines and numerals engraved on an internal mirror-polished surface, are employed for table setting and are read

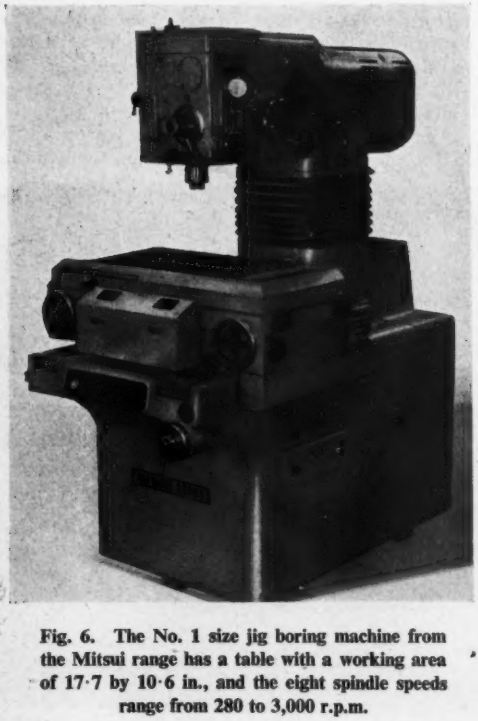

Fig. 6. The No. 1 size jig boring machine from the Mitsui range has a table with a working area of 17·7 by 10·6 in., and the eight spindle speeds range from 280 to 3,000 r.p.m.

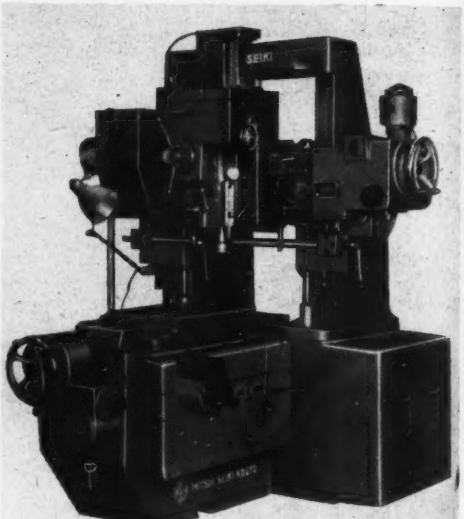

Fig. 7. Standard precision scales employed on the Mitsui No. 3 size jig borer are read with the aid of a screen provided with a split graticule, that can be moved by a micrometer drum graduated in 0·001-mm. divisions

by means of an optical system. This system permits direct reading to 0·001 mm. (0·00004 in.). The screen is of such a width that at least two scale lines are visible at any time, and it is engraved with a series of double lines, numbered from 0 to 10, each of which represents 0·1 mm. A glass disc, incorporated in the optical system, has a specific, closely-controlled refractive index, and is so mounted that it is tilted, by the action of a cam, when a knurled ring in front of the screen is turned.

As the disc is tilted, the images of the scale lines on the screen are displaced sideways by an amount proportional to the angle through which the disc is turned. The knurled ring also rotates a glass disc with an engraved circular scale, immediately beneath the screen, and an image of part of this scale is thrown on to the screen at one side. There are 100 divisions on this scale, any one of which can be aligned with a zero mark on the screen. For each movement of the circular scale through one division, the images of the linear scale are displaced through 0·001 mm. (0·00004 in.). When making a setting, the machine element is first moved to bring the appropriate scale division line to a position on the screen corresponding

to the millimetres and tenths of millimetres required.

The knurled disc is then turned until the division line representing the required number of hundredths and thousandths of a millimetre is on the zero mark, the scale line being thus displaced sideways by a corresponding amount. It is then only necessary to re-centre the scale line between the original double line on the screen to complete the setting. This system is employed for both the No. 0 and No. 1 jig borers and for the firm's optical measuring equipment, of which there is a wide variety. On these machines, the accuracy of setting is within 0·002 mm. (0·00008 in.).

Another jig borer in current production is the No. 3 shown in Fig. 7, which has a table with a working surface measuring 520 by 380 mm. (20·47 by 14·96 in.). The longitudinal travel of the table is 450 mm. (17·7 in.), and the transverse movement of the spindle head on the cross-rail, 350 mm. (13·78 in.). Vertical traverse of the cross-rail is 400 mm. (15·74 in.), and the distance between the uprights is 600 mm. (23·6 in.). The spindle is driven by a 1-h.p., 6-pole motor, and there is a total of 12 spindle speeds, from 50 to 2,100 r.p.m., which are engaged by levers on the gearbox at the left-hand end of the cross-rail.

Six power feeds can be applied to the spindle quill for drilling and boring operations, ranging from 0·001 to 0·01 in. per rev., and power feeds and rapid traverse motions are also available for the table and spindle head to enable milling operations to be performed. Precision scales are again employed for measurement, and there are separate external scales to facilitate approximate setting. Having set the image of one of the precision scale divisions in relation to a split graticule on an illuminated screen, the screen is moved by means of a micrometer drum graduated in 0·001-mm. divisions. The table or spindle head is then moved to re-centre the scale line with the reticle, to complete the setting operation.

Brief reference was made in an article on the Japanese machine tool industry, in MACHINERY, 97/110—13/7/60, to a numerically-controlled jig boring machine, which was described in error as the No. 7 size, but was, in fact, the No. 5 machine from the Mitsui range. This machine, which is shown in Fig. 8, was designed in conjunction with the Japanese Government Mechanical Laboratory, Tokyo, and was exhibited—under the name Jidic—at the Tokyo International Trade Fair in 1959. The production version of this machine, in the No. 7 size, is due to be shown at the next Fair, to be held in April of this year. In addition to the assistance afforded by the Laboratory mentioned, it may be noted that the tape control units were supplied by the Japan Electronic Measuring Instrument Co., Ltd., and reading units by the Tokyo Optical Co.

The machine illustrated has a table size of 1,000 by 760 mm. (39·37 by 29·9 in.), and table and spindle head movements of 1,000 and 600 mm. (39·37 and 23·6 in.). Drive to the spindle, which has a boring traverse of 190 mm. (7·48 in.), is taken from a 3-h.p., variable-speed D.C. motor, supplied from a Ward-Leonard set, and steplessly variable speeds from 40 to 2,000 r.p.m. are obtainable. Any of 20 spindle speeds, within the range quoted, can be engaged automatically by depression of a push button, marked with the speed, at the right-hand end of a control panel at the side of the table, shown in the close-up view, Fig. 9.

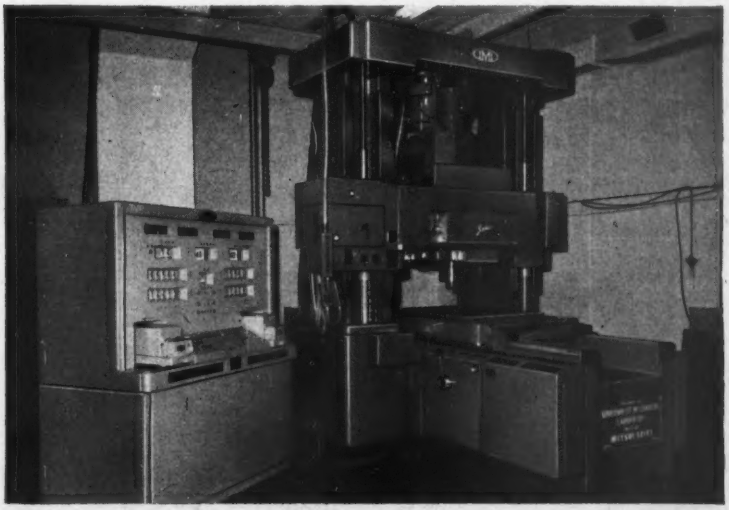

Fig. 8. Prototype Jidic machine, developed from the Mitsui No. 5 jig borer. It is arranged for numerical control from punched tape, and the unit at the left incorporates two tape reading heads

Drive to the spindle is transmitted through an electro-magnetic clutch, and the speed of the driving motor is governed by an automatic unit, incorporating a servo-amplifier.

This unit ensures that the selected spindle speed is held within 2 per cent of the nominal value, even under full-load conditions. Power feeds to the table may also be selected by push buttons on the panel in Fig. 9, and there is a choice of eight rates from 0·012 to 0·3 mm. (0·00047 to 0·0118 in.) per rev. Other push buttons on the left-hand side of the panel in Fig. 9, reading from the left, in groups, provide for clamping the quill for milling operations; changing from manual to automatic tape control; controlling table movements; and for starting automatic cycles. In addition, there are push buttons on the pendant panel seen in Fig. 8 for controlling spindle rotation; feed direction; table, spindle head, and cross-rail movements; tool clamping; and rapid traverse.

A feature of the machine is the method of mounting the spindle head on the cross-rail, to ensure adequate support, also the design of the cross-rail, which provides maximum resistance to deflection under the cutting forces. A view of the machine from above, showing the construction of the cross-rail, is given in Fig. 10, and it will be seen that it is of one-piece box construction, with a front and a rear beam. The main portion of the spindle head is located between these beams, and it moves on circulating rollers on flat ways. Guidance for the head is provided by a vee and a flat way on the under-sides of the front and rear beams respectively.

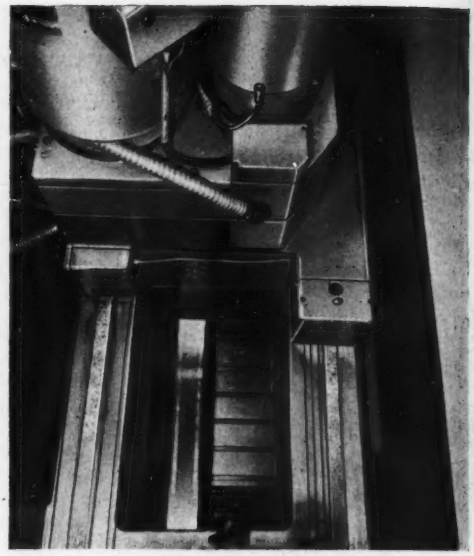

Fig. 10. This view, from above, shows the design of the double cross-rail on the Jidic machine. The spindle driving motor and the quill housing are seen at the top left and right, respectively

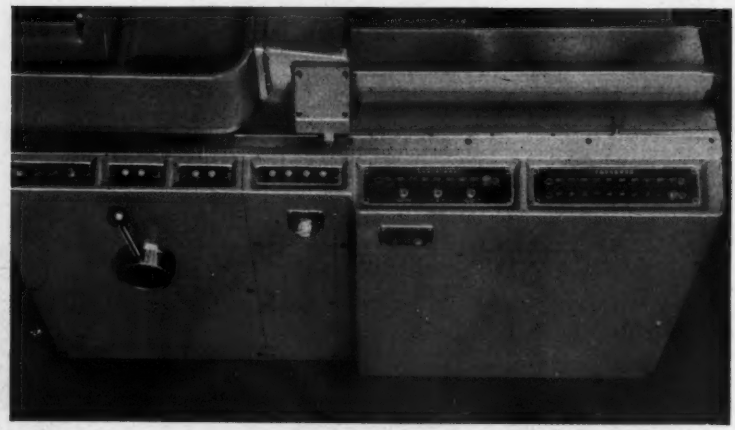

Fig. 9. Close-up view of the push-button station, at the left-hand side of the bed of the Jidic machine, which provides for the selection of spindle speeds and feeds, and for controlling certain machine functions

AUTOMATIC POSITIONING SYSTEM

Automatic point-to-point positioning of the table on one axis, and the spindle head on another, in accordance with information on punched tape, is controlled by the unit at the left in Fig. 8, which contains some 3,500 "parametrons," 100 relays and 50 vacuum tubes, and has logic and data-handling circuits. Information is fed to this unit by means of two separate punched tapes, one of which controls the sequence of operations, operating conditions, and a read-out unit whereby the operator is notified of the next tool to be fitted to the spindle, by means of a code number. The second tape provides in-

formation concerning the co-ordinates of points at which drilling or boring operations are to be performed, and these dimensions are also shown on a read-out unit on the vertical panel, both the current and the next position being indicated.

Movements of the table up to a maximum stroke of 1,000 mm. (39·4 in.) are powered by a combination of hydraulic cylinder and electric motor, the table being moved to within 1 mm. of the required position by the cylinder. The arrangement is shown in part in Fig. 11, and it will be seen that the end of the ram enters a housing near the under-side of the front edge of the table. In this housing there is a nut, which engages a thread on the end of the ram, and this nut can be turned by the motor seen above the housing, through spur and worm gearing, to provide for final positioning. The maximum speed of the table is approximately 6 ft. per min., and the motor has two speeds which give table movements at the rates of 10 and 1 mm. (0·39 and 0·039 in.) per min. for traversing to the final position.

A slightly different arrangement is employed for the movement of the spindle head on the cross-rail. There are two motors which provide for coarse and fine adjustments, the former movement being at half the rate for the table, whereas the fine adjustment rates are the same. For coarse positioning, photo-electric cells are employed to count 1-mm. division lines on the precision scales attached to the bed and cross-rail. For fine positioning movements, over the final decimal portions of a millimetre, with drive by electric motors, as described, there are detector units, each of which incorporates a pair of crossed-axis diffraction gratings to produce a moiré fringe effect, a micro-projecting lens system, and a photo-electric cell.

A close-up view of the table unit is given in Fig. 12, where the lamp housing is seen at *A*, and the photo-electric cell is housed beneath the cover *B*. The moving diffraction grating is carried on the slide *C*, which is normally free from the table but can be connected to it by a magnetic clamp. This clamp is operated immediately the pulse generated by the last of the 1-mm. division lines on the main scale is received, and the fine

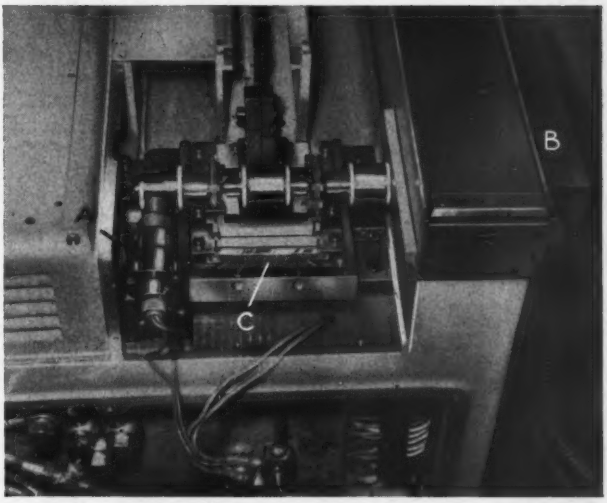

Fig. 12. Final positioning of the table and spindle head on the Jidic machine is effected by means of crossed axis diffraction gratings. This view shows the table-positioning unit, and the moving grating is carried on the slide *C*

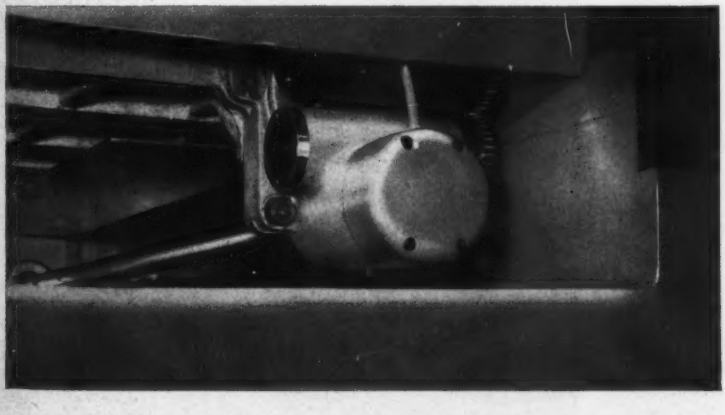

Fig. 11. Fine-positioning movements are imparted to the work-table of the Jidic machine by a small electric motor which drives a nut engaging a thread on the end of the ram of the hydraulic cylinder employed for coarse positioning

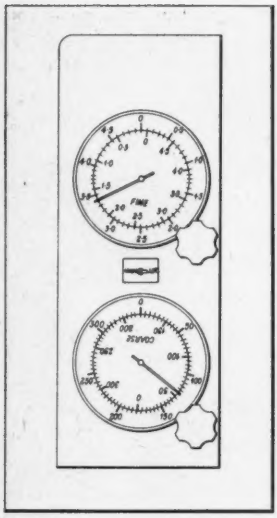

Fig. 13. This unit, which is to be mounted on the end of the cross-rail of the Jidic machine, provides for pre-setting the depths for jig boring operations

traverse motor is simultaneously started. Each movement of the table through 0·001 mm. (0·00004 in.) now produces one complete movement of the moiré fringes obtained from the diffraction gratings. The pulses are counted, and when the required number is reached, the fine feed motor is stopped.

DEPTH MEASURING UNIT

A recent development, not provided on the machine in Fig. 8, which will be incorporated in the production version, is a depth measuring unit designed to monitor the position of the spindle quill throughout its stroke and to arrest the movement accurately and automatically, at any selected position. Movements of the quill are obtained by means of a rack and pinion, and a synchro-transmitter is so arranged that it is driven from the same gearing. One revolution of this synchro corresponds to 5 mm. (0·2 in.) of quill travel, and it is connected to a receiver unit at the left-hand end of the cross-rail, in a convenient position for the operator.

The dials on this receiver unit are shown in the drawing, Fig. 13. There is an upper dial for fine, and a lower dial for coarse settings, and the unit contains a synchro-controlling transformer, connected to the quill synchro. When the quill is moved, a voltage is set up between the two synchros, and is applied through an amplifier to a servo motor in the receiver unit. This motor drives the synchro-controlling transformer and the pointers on the fine and coarse-setting dials. The position of the quill, or the height of the tool above a datum, can be read from the positions of the pointers on the fixed circular scales, the scale for the coarse setting being graduated in 5-mm. (0·2-in.) divisions up to a total travel of 350 mm. (13·8 in.), and that for the fine setting in 0·02-mm. (0·0008-in.) divisions, up to 5 mm.

For boring a hole to a selected depth with this unit, the tool is lowered until it touches the surface of the work, and the height of the quill is indicated by the positions of the pointers on the fixed outer dials. A knob adjacent to each dial is then turned, to rotate the inner portion until its position relative to the pointer corresponds to the depth at which boring is to be stopped. In the example shown in Fig. 13, the pointers are indicating a depth of something more than 120 mm. on the coarse outer scale, and a further 3·4 mm. on the fine scale. The inner scales have been set for a depth of just over 55 mm. on the coarse, and a further 1·7 mm. on the fine scale, making a total of 56·7 mm. When these inner scales are rotated, by means of the knobs shown, the settings of the synchro-controlling transformer and of an electrical contactor are changed.

Fig. 14. The range of five Mitsui cylindrical grinding machines includes this MUG 25 by 50 universal machine, the remainder being of the plain type. Work-heads for these machines incorporate cone-and-ring type variable-speed units

Machining is then carried out by moving the switch shown from the manual to the auto position, and pressing the spindle rotation and feed push-buttons. While the feed is being applied, the voltages produced by the quill-synchro and the syncho-controlling transformer are continuously compared, and when these voltages coincide a relay is operated. This relay controls a magnetic clutch through which the feed motion is transmitted to the quill, and the latter is thus stopped at the pre-set position, the pointers on the dials having moved to the zero positions on the inner scales.

MITSUI CYLINDRICAL GRINDING MACHINES

The range of Mitsui cylindrical grinding machines includes the type MUG 25 by 50 universal machine, shown in Fig. 14, which will grind components of diameters up to 100 mm. (3·93 in.), and admits a maximum length of 500 mm. (19·68 in.) between centres, for external grinding. Here fitted with a 3-jaw chuck for holding work for internal grinding, the work-head incorporates a mechanical cone-and-ring type unit which provides steplessly-variable spindle speeds from 50 to 500 r.p.m., and is driven by a motor of 1·5 h.p. The internal grinding spindle, seen in the grinding position, is driven at 20,000 r.p.m., by a 3-h.p. motor, and can be used for grinding bores up to 150 mm. (5·9 in.).

For external traverse grinding, the table, which can be swivelled through angles up to 12 deg. in each direction, is reciprocated hydraulically at steplessly-variable speeds up to 16·4 ft. per min. Plain cylindrical machines are also made with capacities for grinding work up to 10·43 in. diameter by 4 ft. long. Wheel spindle bearings on these machines are of the wedge type and are pressure-lubricated. Provision can be made for automatic size control by means of a caliper unit operating on the variable-capacitance principle.

MITSUI-RENAULT MACHINES

Machines so far built with Renault unit heads have been of the single-operation type, or designed for manual transfer of components, but automatic transfer machines are now being designed. A machine made for drilling and tapping operations on motor car engine connecting rods and caps is seen in Fig. 15, and it has one TEM-II head with motor-driven feed, and three TEP-OA heads with electro-pneumatic feed. On this machine, five fixtures of similar design are employed, each of which holds one rod and its cap, and they are moved from one head to the next along continuous dovetail ways. At each machining position the fixture is located by a spring-latch and a plunger, and it can be secured to the ways by means of a lever which turns a screw to apply a clamping force to the gib at one side.

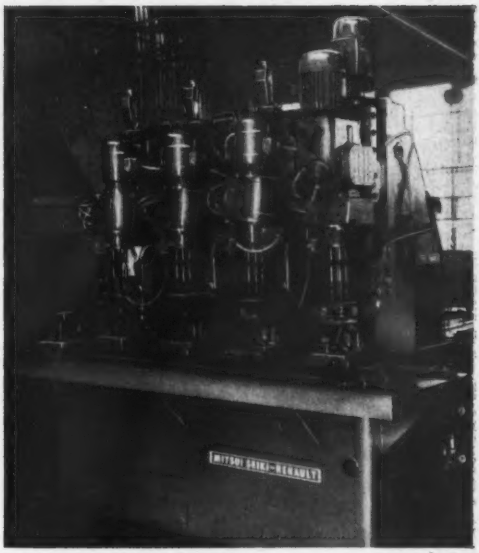

Fig. 15. One of many special-purpose machines constructed by the Mitsui company with unit heads built under licence from the French Renault organization. It provides for drilling and tapping operations on connecting rods and caps

Parts are loaded and unloaded at the right-hand end of the machine and the fixtures are advanced manually towards the left, and are finally returned to the right, for unloading, along a roller track at the front. Normally, at least two men are employed on the machine, one for loading and unloading, and the other for moving the fixtures and starting the cycles of the heads.

Other equipment which has been built with Renault heads includes units for deep-hole drilling, with "woodpecker" feed, fine-boring machines for transmission housings, a crankcase reaming machine incorporating an automatic measuring unit for checking the bores, and a 3-way machine for boring and tapping operations on crankcase castings.

Further articles concerned with machine tool factories in Japan, and with other Japanese metal-working plants, will be published in forthcoming issues of MACHINERY.

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Telecontrol Communication and Recording System in a Bearing Factory

By ROBERT B. PARKER*

IT WAS FOUND THAT INTERMITTENT and unpredictable short-period interruptions in the production obtained from various machine tools were causing, collectively, considerable loss of production at the bearing plant of the Hoover Ball & Bearing Co., Ann Arbor, Mich., U.S.A. Specific reasons for these short interruptions—often amounting to only a few minutes on individual machines—could not always be assigned by the foremen.

To ascertain the reasons for such inefficient utilization of capital equipment—and thus enable them to be analysed, and corrective measures taken—Telecontrol was installed. The equipment, made by the Telecontrol Division of Hancock Industries, Inc., Jackson, Mich., provides, among other functions, a simple electro-mechanical method of registering production data for each individual machine in a centralized control room. The equipment also affords a plant-wide signalling and communications system.

* Hoover Ball & Bearing Co., U.S.A.

With Telecontrol, work stations and machine tools are equipped with sensing devices to count, electrically, the number of workpieces produced. The sensing device used on a Conomatic 4-spindle bar automatic of 3½-in. capacity is illustrated in Fig. 1. As each machined bearing race is indexed to the parting-off station, it contacts and pivots a spring-loaded rod that projects from the under-side of an Allen-Bradley limit switch. On some of the smaller automatics, it is necessary to arrange for the counting lever to pivot into the tooling area during each indexing cycle, on account of space limitations.

Each sensing device is connected to a control box, such as that shown mounted on the right-hand end of the Acme-Gridley 6-spindle automatic in Fig. 2. This machine is set up to produce inner races for water-pump bearings. The control box is equipped with red and green signal lights, an operator's toggle-action "help" switch, a key-operated down-time switch, and a socket into which a portable telephone handset can be plugged, as

seen in the heading illustration. "Press-to-talk" telephones, carried by the foremen of the various departments, enable 2-way conversations to be carried on with the despatcher in the control centre seen in Fig. 3.

Wiring to transmit signals from the various machine control boxes, also the sensing device counts, is connected to individual control panels in the central room. Twenty of the individual control panels are mounted in a vertical cabinet, and the four cabinets in the Hoover installation provide for 80 production machines or stations. Additional cabinets could easily be installed to expand the installation whenever required.

Each individual control panel has two sets of three counters, as seen in Fig. 4. One set of counters is used for the current working shift, and the other set for the following shift. The left-hand counter in each set indicates the productive time elapsed in 0·01-hour (36-sec.) increments; the centre counter shows the down time (non-productive) elapsed in the same time increments; and the right-hand counter records the number of workpieces produced. A "balance" counter, which is pre-set at the start of each shift, is also provided at the right of each panel to indicate the number of parts still to be produced to complete the particular order.

Fig. 2. When an operator needs material, or the assistance of an inspector or setter, he moves a switch on the machine control box to the "help" position

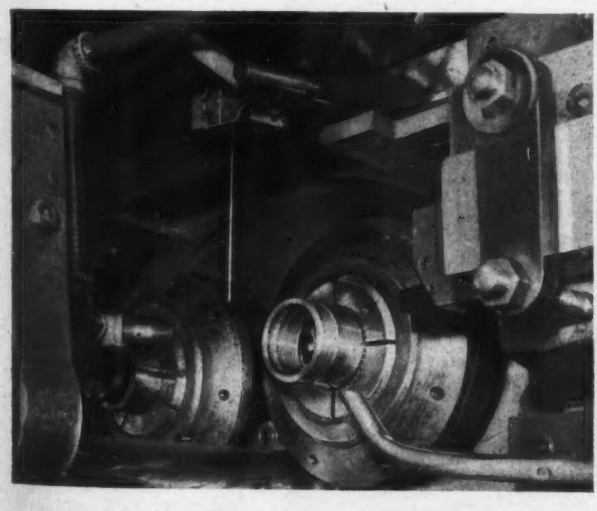


Fig. 1. As each bearing race is indexed to the parting-off position on an automatic, it operates a limit switch to actuate recording equipment in a control room

Each individual control panel is also equipped with a red and green signal light (corresponding to those on the individual machine control boxes), two activating sockets, to receive an operator's or setter's plug for the shift, and slots for holding the machine identification number and an IBM job-order card. Standard printed cards are also provided for insertion in the slots to indicate that the machines are "unscheduled," "being set up," or "ready to run." To activate a particular control panel, a plug having an operator's or setter's number is inserted in one of the two sockets. This plug completes the circuit to the corresponding machine control box and its sensing device.

A master programmer, which is an integral part of a Telecontrol monitor cabinet (seen at the left in Fig. 3), energizes the entire system at the beginning of each shift in synchronization with the master time clock for the works. In addition to per-

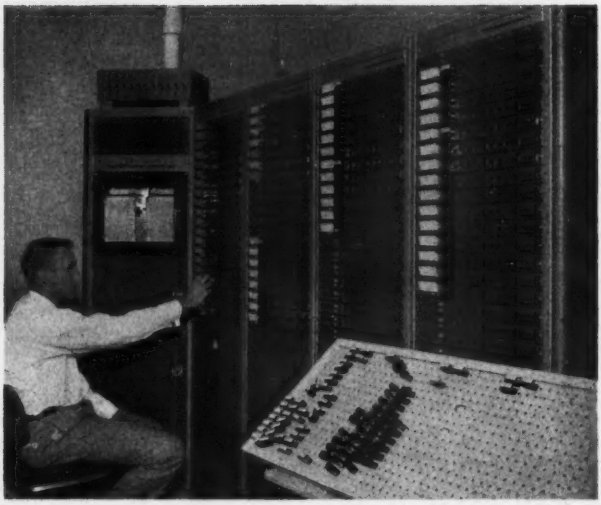


Fig. 3. In a central control room there are individual panels which are connected by wiring to control boxes and sensing devices on various machine tools throughout the works

forming other functions, the programmer switches on the green lights on the control panels, as well as the corresponding green lights on the control boxes of the various machines scheduled for operation during the shift. The operators know that when the green lights are on, their machines are ready for production, and that the corresponding panels in the control room are registering productive time and will automatically record each unit produced by the machines.

When the required number of workpieces has been produced on a particular machine, the green lights on both the machine control box and the corresponding panel in the control room automatically start to "blink." The blinking green light warns the machine operator to stop producing parts, and notifies the despatcher in the control room that he must contact the foreman of the particular department in which the affected machine is installed. An aural "beeping" signal accompanies the flashing of any green light in the control room. Thus, over-runs or under-runs of production are automatically controlled and eliminated.

Before each order is completed, the control-room despatcher selects the next job to be run on the particular machine involved and inserts the job-order card in the slot of the control panel for that machine.

Whenever a machine operator needs assistance, for example, if he requires a fresh supply of raw material or the removal of machined parts, he moves the switch on his machine control box to "alarm", as indicated in Fig. 2. This action causes the red light on the box to "blink", also the light on the corresponding panel in the control room. The aural "beeping" further prompts the control-room despatcher to contact the foreman of the proper department by means of a voice "paging" system. Upon arrival at the affected machine, the foreman plugs his portable telephone handset into the intercom socket on the control box, as seen in the heading illustration, and advises the despatcher of the specific type of service needed. The despatcher then uses the voice paging system to summon the necessary material or the work handler. In the meantime, the operator continues to run the machine,

Fig. 4. Each control panel has two sets of three counters to indicate the productive time, down time, and number of parts produced during two successive working shifts. There is also a counter showing the number of parts still to be produced

Fig. 5. Data on productive time, down time, and the number of parts produced on each machine are automatically charted on this 40-pen recorder

and produces workpieces without any interruption.

Should the machine operator need assistance at any time because of tool or machine failure, he summons and receives help from the despatcher and foreman in the same manner. Under such conditions, there will necessarily be some down time, but it is of relatively short duration because of the high-speed signalling and communication facilities afforded by Telecontrol. For example, the operator does not have to leave his machine to look for the foreman to report the breakdown, nor does he have to clock his down time "in" and "out".

Upon arrival at the affected machine, the foreman immediately transfers the machine operator from productive time to down time by inserting and turning a key in the down time switch on the machine control box. This action causes the red signal lights on both the machine control box and the panel in the central control room to glow without flickering. At the same instant, the recording of time is automatically switched from the productive to the down-time counter, and the unit counter is simultaneously disconnected. Upon completion of the repair work, the foreman or machine operator resumes production by depressing a re-set button, which returns the down-time switch to its original position on the machine control box. This action switches the time recording back to the productive counter, turns off the red signal lights, and re-connects the parts counter.

At the end of each shift and upon the completion of each job order, the control-room despatcher takes the relevant information from the control panels and transfers it to printed forms, and to IBM cards, which are subsequently punched. The information includes productive time, down time, parts produced, and balance to be produced. The despatcher also turns the counters to zero and resets the balance counter if an order has been completed. The on-and-off time cycles and the number of parts produced on each machine are also automatically charted on the graphic or "events" recorder shown in Fig. 5. This recorder has 40 pens and is an integral part

Fig. 6. Telecontrol equipment is installed on this Cincinnati Micro-Centric machine, which is set up for grinding ball grooves in inner races

of the Telecontrol monitor cabinet in the central control room. The number of parts produced is plotted on a running time chart. Each time that the sensing device on a machine is operated when a part is produced, the corresponding pen draws a horizontal line on the chart paper. The charts move vertically past the marking pens at variable rates. They are kept as permanent records, and are valuable in determining the performances of individual machines with respect to set-up time and "down" time and for setting or checking work standards.

With the centralization and automation of the gathering and recording of timely, accurate production data afforded by Telecontrol, an immediate analysis could be made of the reasons for "non-visible" down time. The study was first concentrated on single- and multi-spindle bar automatics, because of their intermittent operation and unpredictable short-time interruptions in output. While it was realized that setting up on such machines required a relatively constant percentage of the available productive time, it was revealing to find from the Telecontrol data that approximately an equal amount of the available time was being lost in waiting for the machines to be set up. Immediate steps were taken to minimize this waiting time.

Telecontrol equipment has also been applied to the Cincinnati Micro-Centric machine in Fig. 6, which is used to grind the ball grooves on inner races of ball bearings. Here, a foreman is seen talking to the control-room despatcher about the next job to be processed on the machine. Another machine equipped with Telecontrol equipment is a Heald Centri-Matic bore grinder.

One of the major benefits of the Telecontrol installation has been improved scheduling. Previously, scheduling was often a problem, particularly in the automatic screw machine department. Here, about 150 different parts (out of a total of 450) must be scheduled each month for production on 30 machines. Since each operator usually tends a bank of four machines, it is a considerable advantage if it can be arranged that two or more machines in any bank will not complete job orders and require setting up during the same shift.

Prior to installation of Telecontrol, it was difficult to avoid this situation due to the delay in obtaining control data. Now, with accurate production data instantly available from Telecontrol, it is possible to mix large and small job orders among different banks of machines and authorize over-runs or even decrease the order quantity. In this way, work completions can be readily controlled. Improved machine loading and maximum utilization of expensive capital equipment has also made possible better stock control. Improved scheduling permits stocks to be reduced which, in turn, results in more profitable operation of the machines.

Another major benefit obtained with Telecontrol is that paper work has been eliminated from the shop. Clerical work is now undertaken by clerks, and operators can concentrate on tending their machines. Previously, the operators had to keep records, including a machine log that gave operating time, down time, and the reasons for down time. Also, a production ticket had to be filled out for each job order. Such paper work occupied considerable time.

The delay between factory paper work, accounting tabulation, and management analysis was slow and costly. Now the management can, at a glance, observe and analyse the productive effort of the entire plant by visiting the control centre or noting the timely, accurate data obtained by Telecontrol. Immediate information is available as regards which machines are operating, which orders are nearing completion, and the orders that can be scheduled next on the various machines. Paper work required in connection with pay-rolls, accounting, and invoicing is also minimized.

"STREAM-LINE" FILTERS FOR SPARK EROSION MACHINES. Cleanliness of the dielectric fluid (usually paraffin or transformer oil) employed on spark erosion machines is of great importance. Stream-line Filters, Ltd., Henley Park, Guildford, Surrey, who have been working in close collaboration with makers of spark erosion equipment, have introduced a new unit for the purpose which operates on the principal of edge filtration, and is very effective for the removal of solid matter from the fluid.

The unit is so constructed that filtration can be either continuous or on a batch basis according to requirements. For continuous filtration, the unit is coupled directly to the spark erosion oil line in a closed circuit and the contaminated liquid flows into the filter where it is cleaned and returned to the machine. For batch filtration, there are two 20-gal. tanks, one for contaminated and one for clean fluid, each with a separate motor-driven pump.

The dielectric liquid in the contaminated tank passes through the filter and flows into the clean tank ready for transfer to the spark erosion machine. A metal drawer is provided at the base of the filter to catch the sludge when cleaning is carried out by blowing compressed air through the filter packs in the reverse direction.

The Lamalock Hydraulic Pressure-unit System

By S. C. POULSEN, Associate Editor

CERTAIN APPLICATIONS of the Lamalock hydraulic pressure-unit system (A. E. Sykes, 5 Harrison Street, Leicester, Brit. Pat. No. 802278) have already been mentioned in MACHINERY (94/507—4/3/59, 97/1201—23/11/60, and 97/1341—14/12/60). In the first of these articles, reference was made to the use of Lamalock self-adjusting, hydraulically-locked plungers in a special type of adapter plate for use on magnetic chucks, and in the second, to an application of the Lamalock principle in a design of collet chuck capable of exerting an exceptionally high gripping pressure. Both these items, it may be noted, are produced by A. E. Sykes, and marketed by A. A. Jones & Shipman, Ltd., Narborough Road South, Leicester. In the third article, attention was drawn to a machining fixture employed by Hoover, Ltd., Perivale, for holding die castings of "difficult" shape. In this example, self-adjusting Lamalock plungers are used to back-up the work, and are locked by the action of an associated cam and hydraulic unit. Here, the Lamalock system as a whole is considered.

The name "Lamalock" is derived from the term "lamella," which is used in the patent specification to denote the particular type of hydraulically-operated pressure-unit that characterizes the system. Such a unit comprises a plate, annulus or bush, sealed around the edges, and preferably mounted on one of the locking members. Hydraulic pressure is applied to the inner surface of the "lamella," which is thereby distorted. Fluid pressure is thus converted to mechanical pressure of the "lamella" against the member to be locked.

There are many variants of this basic principle, and typical applications include, in addition to those already mentioned, the locking of slides, quills and sleeves; the elimination of backlash in nut-and-screw systems; the operation of various types of clutches; and controlled reduction in diameter of bores and bearings. Among machine-tool builders who are Lamalock patent licensees, for applications of this type, may be mentioned George Richards & Co., Ltd., Cunliffe & Croom, Ltd., James Archdale & Co., Ltd., Wickman, Ltd., Alfred Herbert, Ltd., Newall Group Sales, Ltd., O.M.T., Ltd., Keighley Grinders (Machine Tools), Ltd., and Standard-Modern Machine Tool Co., Ltd. (Canada).

The Lamalock principle is well exemplified by the self-adjusting plungers of the J. & S. Lamalock adapter plates for use on magnetic chucks. One of these plates, of the latest design (Brit. Pat. No. 849128) is shown set up on a 24-in. by 8-in. Eclipse magnetic chuck, on a J. & S. type 1400

Fig. 1. A J. & S.-Lamalock adapter plate of the latest design, for use on magnetic chucks, is here seen set-up on a J. & S. type 1400 surface grinder

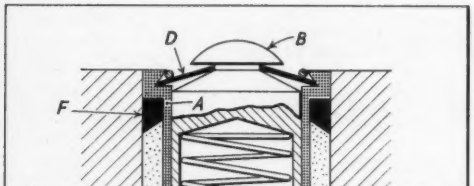


Fig. 2. Sectional view of a typical self-adjusting Lamalock plunger, as incorporated in the adapter plate seen in Fig. 1. Hydraulic pressure is applied by means of a piston-screw

surface-grinder, in Fig. 1, and a sectional diagram of one of the plungers is given in Fig. 2. The plate is built-up from alternate transverse strips of magnetic and reinforced plastics material, bonded together with Araldite epoxy resin [CIBA (A.R.L.), Ltd.] and this form of construction ensures that the plate is magnetic across the full width, irrespective of the arrangement of the pole-pieces of the chuck. It also enables the unit to be used on chucks of all makes, which may be either larger or smaller than the plate. These plates are available in sizes of 14 in. by 6 in., 18 in. by 6 in., and 24 in. by 8 in., which are provided with 45 (9 × 5), 55 (11 × 5), and 84 (14 × 6) evenly-spaced plungers, respectively, and can be used for holding components down to 2 in. square.

Each plunger assembly (Fig. 2) is housed in an enlarged portion of one of the magnetic strips, and comprises a thin-walled bush *A* (the "lamella"), in which the hardened steel plunger *B* is an accurate sliding fit. The plunger is upwardly loaded by the light compression spring *C*, and is retained and sealed against the entry of dirt by the synthetic rubber diaphragm *D*. Hydraulic fluid is contained in the annular space *E*, between the outer walls of the bush and the bore in which it is housed, and high-pressure ring seals are provided at *F*. The spaces *E* are connected by the channels *G*, which form a closed circuit that also communicates with a screw-type piston and a pressure-limiting device termed an "alleviator." This device comprises, in effect, a spring-loaded piston arranged to oppose the hydraulic fluid pressure, and since the volumetric changes in the circuit—and hence, the displacement of the piston—are relatively small, the maximum hydraulic pressure is of a substantially constant predetermined value, determined by the spring setting. The alleviator is housed in the sleeve *H*, Fig. 1, and the second sleeve contains the screw piston.

Initially, the pressure in the circuit is reduced by unscrewing the piston with a key, so that the plungers can move freely, and the work is then placed on the plate. The plungers are thereby depressed by the under-side of the work, and are then locked by tightening the piston, to pressurize the circuit, so that they are securely gripped by the bushes. A foam plastics pad is provided, for use if the work is too light to depress the plungers. In this event, the pad is placed over the work, and weighted just sufficiently to depress the plungers without causing distortion. The plungers are then locked, and the pad is removed.

With either procedure, the attainment of the correct locking pressure is indicated by the protrusion of the stem of the alleviator beyond the end of the sleeve *H*. Because of the high efficiency of this method of clamping the plungers, combined with area-ratio effects, very little manual effort is required to build-up the required hydraulic pressure by tightening the piston. The alleviator is therefore provided as an automatic safeguard against distortion and/or damage to the plate, through excessive internal pressure.

When the magnetic chuck is switched on, the work is held firmly on the "matrix" formed by the tops of the plungers, in an unstressed condition. Any tendency for it to be pulled down flat on the chuck—only to spring back again when released after it has been machined or ground—is thus eliminated, regardless of initial out-of-flatness of the under-side. In the particular application here considered, the maximum out-of-flatness that can be accommodated by the plungers is 0·03 in.

The holding force afforded by the combination of plungers and magnetism is considerable, since any tendency for the work to rock or spin about a "high spot" is eliminated. It is, in fact, stated to be adequate for such operations as milling and planing, as well as grinding. Should the work tend to distort during grinding or machining, due to the release of internal stresses, such distortion can readily be accommodated, and subsequently corrected, merely by releasing and re-locking the plungers, with the chuck switched off. Once the upper face has been machined or ground accurately flat, the adapter plate is removed, and the flat face is held directly on the magnetic chuck, for the completion of the second face. A high degree of accuracy and parallelism are thus ensured, even on relatively thin flexible components.

It is pointed out that the Lamalock system, in general, is readily adaptable to automatic operation, with little or no modification of the basic elements. For example, the hydraulic circuit, instead of being energized by the screw-type piston, can be coupled directly, or indirectly through a differential piston, to a hydraulic or pneumatic machine circuit. Alternatively, the necessary hydraulic pressure can be provided by a cam and an associated hydraulic unit, as in the application at the works of Hoover, Ltd., already mentioned, but with the cam power operated. With $\frac{3}{16}$-in. bore tube between the hydraulic unit, piston or other pressure source, and the Lamalock unit, the latter may be operated remotely, at distances up to 100 ft. Since the circuit is virtually static, the alleviator, also, can be arranged in almost any desired position in relation to the other units.

The movement of the alleviator can be utilized to trip micro-switches for the actuation of sequence relays or other devices, or for the illumination of signal-lamps. Even with such a simple application as the adapter plate and magnetic chuck, an automatic or semi-automatic set-up could readily be provided. For example, by employing an electro-magnetic chuck, and a micro-switch associated with the alleviator, it could be ensured that the chuck was not energized until the plungers were locked. Similarly, the movement of the alleviator, or the energizing of the chuck, could be used to initiate the machine cycle. Since such a set-up would be inherently self-sequencing, it would also provide automatic safeguards against failure of the power-supply to the chuck, or loss of pressure in the hydraulic or pneumatic circuit.

LAMALOCK "JACKING SYSTEM"

In addition to the Lamalock plungers in the adapter plates described, a Lamalock "jacking system is available. This system, which is based on the same principles, is designed to facilitate the setting-up of non-magnetic components, and to render automatic the tedious—and often improvised—manual adjustments normally necessary for supporting and levelling "awkwardly" - shaped items such as castings. For this purpose, the plungers can be supplied as complete self-contained units, in a variety of designs, including foot-mounted types, which can be arranged in series and coupled to a single hydraulic unit, or used individually. With the latter arrangement, each plunger unit is provided with a screw piston actuated by means of a knurled knob.

These units are so designed that they can readily be incorporated in jigs and fixtures, in the same way as other standard tooling units. Where a fixture is not employed, levelling or other alignment is usually carried out by adjusting jacking screws provided on the tops of the plungers, before the latter are locked and the clamps are tightened. The Hoover example already mentioned represents a typical fixture application, and another potentially useful field, of particular interest to the aircraft industry, is for supporting large flat panels or slabs of aluminium alloy, or other non-magnetic materials, on vacuum chucks.

GRIPPING CHARACTERISTICS

Another important characteristic of Lamalock pressure units is that the conversion of hydraulic to mechanical pressure is effectively uniform throughout the surface of the "lamella". Furthermore, this mechanical pressure can be controlled with considerable accuracy. Where the "lamella" is in the form of a bush or sleeve, the bore-diameter is reduced uniformly throughout, without distortion, when the hydraulic pressure is applied. Nevertheless, surface irregularities of the locked member, provided that they are not excessive, are accommodated by local flexure of the "lamella".

These characteristics account for the high gripping power of the J. & S.-Lamalock collet chuck, which is shown in section in Fig. 3. The "lamella" is seen at *A*, the collet at *B*, and the piston-screw at *C*. Since the assembly is sufficiently robust to

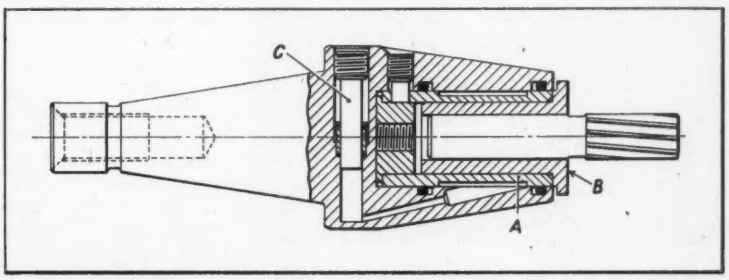


Fig. 3. Sectional view of the J. & S.-Lamalock collet chuck, showing the principal features. The torque is sufficient for tapping 1½-in. Whitworth threads in steel

resist damage through high internal pressure, there is no alleviator. Interchangeable collets are provided, and without a collet, the chuck will accommodate a 1-in. diameter shank. With a shank of this size, sufficient torque can be applied for tapping 1½-in. diameter Whitworth threads in steel. Because of the uniform diameter-reduction of the "lamella" under hydraulic pressure, concentricity is accurately maintained.

In an alternative version of the chuck, shown in Fig. 4, the back of the body is counterbored and threaded, so that it can be mounted on the nose of a milling or boring spindle, or the headstock spindle of a lathe. It can thus be used for drilling, milling and boring, or for bar-turning operations. In the latter capacity, the usefulness of the chuck is enhanced by the fact that the rear of the collet is unobstructed, so that on a lathe with a hollow spindle, any length of bar can be accommodated. As with the standard taper-shank chuck seen in Fig. 3, an eccentric bush can be provided, which, in conjunction with a cranked tool, enables the chuck to be used as an adjustable boring head. Radial adjustment of the cutter is effected by rotating the bush, and can be controlled by reference to graduations on the chuck, and on a spanner provided for this purpose.

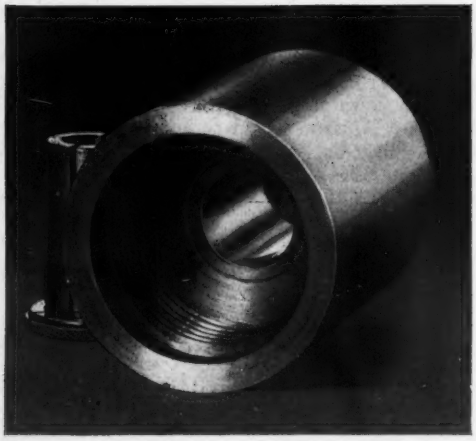


Fig. 4. This alternative version of the chuck can be used for drilling, milling, boring, or bar turning. Bar of any length can be accommodated without obstruction

LAMALOCK TAPPING CHUCK

In view of the characteristics of bush- or sleeve-type Lamalocks outlined above, the recently-introduced Lamalock tapping chuck which is seen in Fig. 5 is a logical development of the collet chuck. The tapping chuck is shown in section in Fig. 6, and it will be observed that the design is substantially the same, except for the addition of the intermediate sleeve *D*. This sleeve, in conjunction with the "lamella" *E*, affords the necessary controlled slip. The sleeve is retained in the "lamella" by the flange *F*, and the "lamella" in the body by the driver *G*. To ensure consistent frictional properties at the interface, the working portions are sealed at *H*, to exclude dust, moisture, and oil. With the same object, and to minimize wear, the working surfaces are coated with a dry preparation of molybdenum disulphide. Disturbances of the slip characteristics, due to axial loads on the sleeve, are minimized by the ball thrust bearing *J*, which is protected against dirt and swarf by the packing disc *K*.

The external dimensions of the tapping chuck are the same as those of the standard collet type (Fig. 3). Interchangeable adapters, *L*, are used to accommodate taps of various shank-diameters, and are retained frictionally in the sleeve when hydraulic pressure is applied to the "lamella" by means of the piston-screw *M*. Relative rotation is

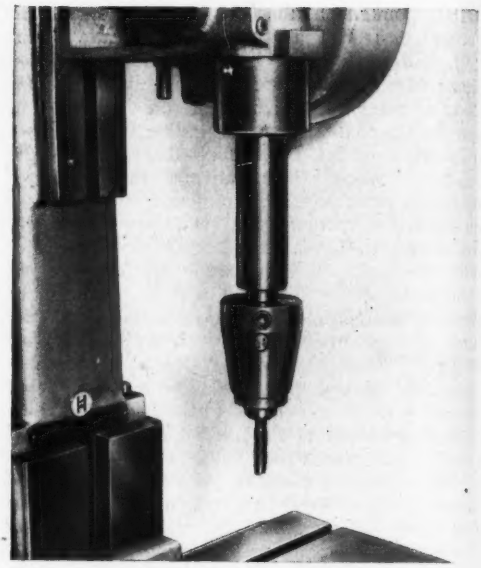


Fig. 5. Advantages claimed for the recently-introduced Lamalock tapping chuck, here shown, include accuracy and ease of torque control. It is set with a torque wrench

prevented by driving dogs on the outer end of the sleeve *D*, which engage corresponding slots in the adapter. The tap is retained in the adapter by the screw *N*, and the square portion of the shank is engaged by the walls of the transverse slot *P*. The slipping torque is pre-set by reference to a chart, on which the various combinations of materials and tap-sizes are tabulated against corresponding setting numbers. A torque wrench, calibrated in these numbers, is set accordingly, and is used to tighten the piston-screw. The sensitivity of adjustment, it is stated, is such as to differentiate between brass and aluminium, for any given tap size.

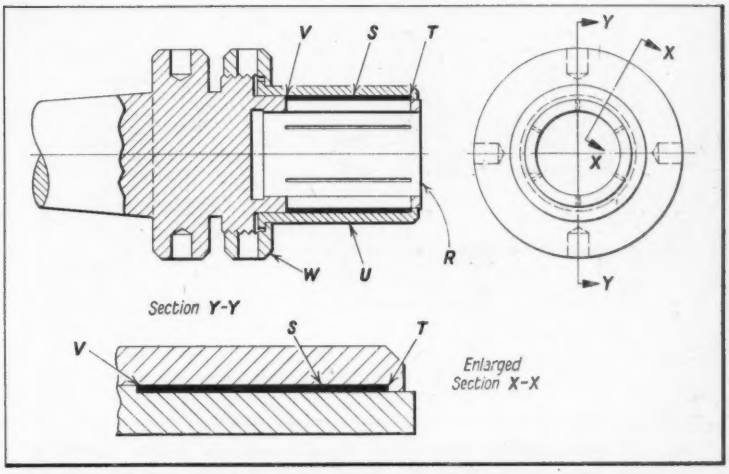


Fig. 7. Lamalock chucks, already noteworthy for compactness, can be further reduced in size by the use of a resilient pressure medium

At present, the tapping chuck is available with a No. 3 Morse taper shank, and will accommodate standard-shank taps with thread-diameters up to ⅝ in. It is pointed out that the maximum torque capacity is well in excess of ⅝ in. Whitworth in steel, and it is therefore possible to use the chuck for taps of larger diameter, with suitably-reduced shanks. The small diameter and low inertia of the adapter and sleeve permit blind holes to be tapped to full depth in soft materials, at high speeds, without damage to the threads. As a further safeguard against variations in slip characteristics, due to conduction of heat to the chuck, and differential thermal expansion effects, the volume of hydraulic fluid is kept to a minimum by the inclusion of a porous filler *Q*, Fig. 6.

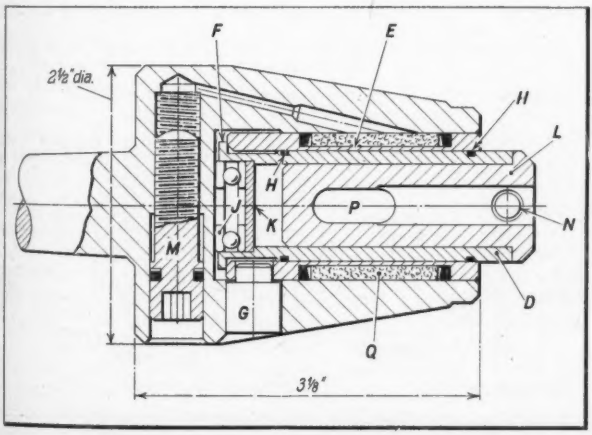


Fig. 6. Sectional view of the tapping chuck, showing the intermediate sleeve *D*, whereby controlled slip is obtained. The adapters *L* are readily interchangeable

The torque-controlling principles embodied in the tapping chuck have other potential applications. A Lamalock torque spanner or wrench, for example, could incorporate a piston-screw provided with a calibrated dial, which would permit direct setting of the slipping torque.

A feature of the collet and tapping chucks described, is the compactness of the body in relation to the diameter-capacity. Even so, the size of the body can be further reduced, by the substitution of rubber or other resilient medium, for the hydraulic fluid. A new design of collet chuck, based on this principle, and still in course of development, is shown in Fig. 7. The gripping portion *R* is integral with the main body and shank, and is slit longitudinally to ensure diametral flexibility. A resilient filling *S* is enclosed between

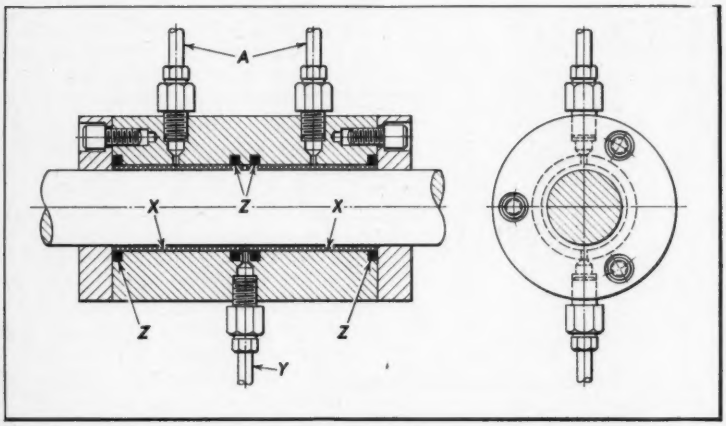


Fig. 8. This Lamalock experimental constant-clearance bearing showed no deviation from circularity or parallelism under hydraulic pressure, with the shaft removed, when checked with an air gauge

the lip *T* on the outer sleeve *U*, the shoulder *V* of the gripping portion, and the inner and outer surfaces of these two members. Thus, when the sleeve *U* is thrust towards the body by tightening the ring-nut *W*, the filler applies hydraulic pressure to the gripping portion. If necessary, loose inserts could be provided, to cover the slits, to ensure that the filler is not extruded into them.

ADJUSTABLE AND CONTROLLED-CLEARANCE BEARINGS

Before proceeding to a consideration of some of the applications of flat and annular Lamalocks, reference may also be made to the potentialities of the bush- or sleeve-type, in connection with journal bearings. Many of the problems encountered in connection with precision spindles running in plain bearings, due to variations in clearance and oil-viscosity with temperature, can be overcome by utilizing the Lamalock principle, namely, by interposing a layer of hydraulic fluid between the bearing shell and the housing. The diameter of the bearing can thus be varied to suit the shaft or spindle under different conditions, without affecting roundness or parallelism.

These variations can be effected manually, by means of a piston-screw, or—with an alleviator in the hydraulic circuit—on a fully-automatic basis. With the latter arrangement, the specific pressure of the lubricating oil film is kept practically constant by the alleviator, regardless of changes of viscosity and bearing-housing diameter, with temperature. This specific pressure can be pre-set or adjusted, by means of the screw associated with the compression spring of the alleviator. With such a system it can also readily be arranged that the diameter-controlling pressure is not applied until full lubricating-oil pressure is attained.

A sketch of a very simple type of Lamalock constant-clearance bearing is shown in Fig. 8. Two bearing shells, each serving as a "lamella," are arranged coaxially in the housing, as at *X*, and lubricating oil is supplied under pressure through the line *Y*, between the abutting ends. Each shell is isolated, externally, from the lubricating circuit,

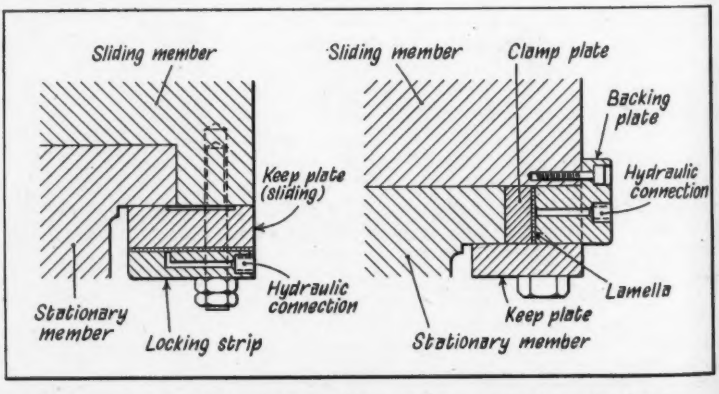


Fig. 9. Two typical applications of flat, plate-type Lamalocks, for locking machine slides, showing recommended methods of installation, and designs of mountings

by the sealing-rings *Z*, which also serve to confine the diameter-controlling hydraulic fluid and pressure, supplied through the lines *A*, to the exterior of the shells. This particular bearing assembly was constructed for experimental purposes, and it is stated that when it was checked with a Solex air-gauge, with the shaft removed, and under hydraulic pressure, there was no measurable deviation from circularity or parallelism throughout the effective length. Among applications for which Lamalock plain bearings are particularly intended may be mentioned the spindles of grinding and boring machines, turbine bearings, and air or gas bearings. It is claimed that they are equally suitable for linear motion, such as that of a boring-machine quill, or a tailstock barrel.

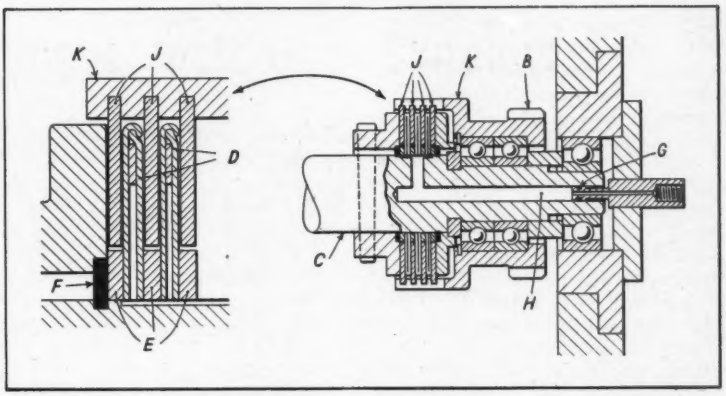


Fig. 10. A typical clutch application of Lamalocks (*J*). A clutch of this design can be run vertically, without undue temperature rise, and there is no axial thrust when the unit is engaged

FLAT AND ANNULAR LAMALOCKS

One obvious application for flat plate-type Lamalocks is for clamping of machine slides, which can be effected in a very simple manner, and if necessary, fully automatically. The only limitation on the use of Lamalocks in this field is that they must be so situated that they are not uncovered at the extremes of slide travel. Two typical applications are shown in Fig. 9, which is self-explanatory. Another application of flat Lamalocks is for clamping milling and other cutter blades in the bodies or holders. In an experimental face milling cutter, for which A. E. Sykes produced the carbide-tipped blades, the shank of each blade was provided with a separate flat Lamalock and piston-screw, to retain it in a corresponding plain slot in the body. The advantages of this arrangement included ease of removal and replacement, for servicing and setting, combined with efficient clamping.

One interesting phenomenon that was observed with this cutter also suggested the feasibility of designing variable-diameter or pre-stressed cutters —the latter to give increased rigidity and vibration-damping properties. It was found that, with little manual effort, it was possible to build-up sufficient pressure to distend the body, so that the effective diameter was perceptibly increased. This phenomenon also demonstrated the high locking forces attainable with Lamalocks, and suggested their use for locking milling cutters to arbors.

Flat annular Lamalocks also have a variety of applications, one of the most important of which is for the operation of clutches. For this purpose, either single-sided or double-sided "lamellæ" can be employed, and among advantages claimed for plate-type clutches operated in this manner may be mentioned the following. Since each plate has a predetermined clearance, it can be run vertically, with no more tendency to temperature-rise than when arranged horizontally. Such a clutch can readily be arranged for remote operation, and if required, through a hydraulic preselector system. It can also be lubricated between the plates when running free. Torque capacity is directly proportional to the number of Lamalocks and plates employed, and since the Lamalocks are self-adjusting, wear is taken-up automatically. Engagement and disengagement can be timed and controlled with considerable accuracy, because of the small movement of each plate and the small volume of hydraulic fluid involved.

A typical Lamalock clutch assembly, incorporating double-sided annular "lamellæ," is shown in Fig. 10, and its function is to couple and uncouple the gear *B* on the drive shaft *C*. The spacing of the "lamellæ" *D* is maintained by the splined washers *E*, which also serve as seals, and synthetic rubber sealing rings are provided at each end of the "stack," as at *F*. Hydraulic pressure is communicated to the "lamellæ" through the running seal *G* and passage *H*, the inner edges of the "lamellæ" being open. To stabilize the "lamellæ" axially,

each contains a loose plate, with suitable oil passages. These plates also serve to reduce the volume of fluid required. When hydraulic pressure is applied, the "lamellæ" are distended, so that the plates *J* are tightly clamped, to transmit drive to the member *K* and the gear *B*. It will be noted that there is no axial thrust, or displacement of the plates, as in a conventional clutch.

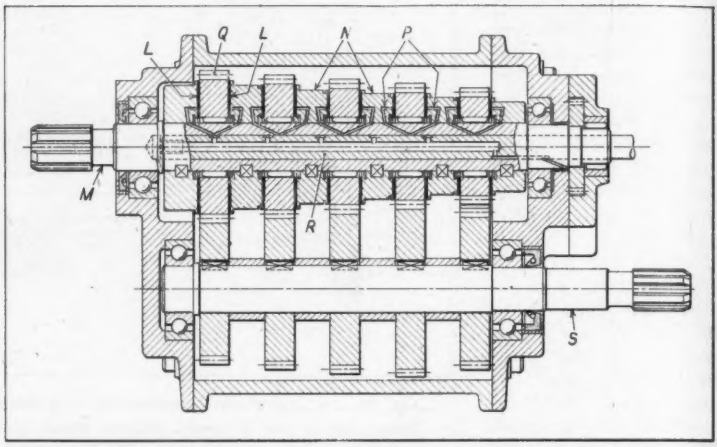


Fig. 11. The possibilities of Lamalock clutches are well demonstrated by this proposed design for a 5-ratio constant-mesh gearbox, with Lamalocks at *L*

Some further potentialities of Lamalock clutches are suggested by the arrangement seen in Fig. 11, which shows a proposed design for a 5-ratio constant-mesh gearbox. Single-sided annular Lamalocks *L* are provided on either side of each gear on the input shaft *M*, and are mounted on the driving collars *N*. These collars are keyed to the shaft *M*, and incorporate passages *P*, that communicate with corresponding passages and ports in the shaft. The driving gears *Q* are locked to the input shaft selectively, by axial displacement of the ported sleeve *R*, through which hydraulic pressure is communicated to the particular pair of Lamalocks selected. This displacement may be effected either by mechanical, or hydraulic means.

All gears on the output shaft *S* are keyed, so that the selection of any particular gear on the input shaft results in the output shaft being driven, the remaining gears on the input shaft meanwhile rotating idly. Since the direction of rotation of the idling gears and the input shaft is the same, the relative speed is comparatively low.

Vario Air Blow-gun

Step Industrial Equipment, Ltd., Lower Kings Road, Berkhamsted, Herts., are the sole agents in this country for the Italian-produced Vario air blow-gun seen in the accompanying figure. This can be used as a normal blow-gun (with full line pressure delivered from the nozzle), as a controlled-pressure gun, which can be pre-set to deliver a light-, medium-, or strong-pressure jet, or as a continuous-delivery gun, with the same pressure settings.

The Italian-produced Vario blow-gun here shown embodies means for adjusting the air pressure

Adjustment is made by means of the straight-knurled ring seen at the right-hand end of the gun, and with this arrangement the pressure of the delivered air can be regulated to suit the particular operation in progress. A spring loaded nylon plunger is incorporated to ensure that the setting is retained.

Air is released from the nozzle by depressing the button seen projecting from the pressure-setting ring. For continuous delivery of air, the setting ring is screwed further down the thread.

The control valve, within the body of the gun, is of nylon, and other parts incorporated in the gun are made from brass or bronze.

Ortlinghaus Multi-disc Clutches

A WIDE RANGE OF MULTI-DISC CLUTCHES, arranged for electro-magnetic, hydraulic, and pneumatic operation, is made by the firm of Ortlinghaus-Werke, Western Germany, for whom the agents in this country are Soag Machine Tools, Ltd., Juxon Street, Lambeth, London, S.E.11. Within recent years, the German company has paid particular attention to the requirements of the machine tool industry as regards multi-disc clutches of the types mentioned above, on account of the increasing application of such units to automatic machines, and notably those which are incorporated in linked production lines and fully-automated installations. On such machines, it is often necessary that spindle speeds, and directions of rotation, also feed rates and directions of traverse, should be changed frequently, in a predetermined sequence, and for these duties multi-disc clutches may offer various advantages.

Electro-magnetic clutches are often particularly suitable for such duties, on account of their rapid response characteristics and the ease with which they can be incorporated in electrical circuits and controlled by limit switches, for example. On the other hand, the torque-carrying capacity of an electro-magnetic clutch is always limited by the strength of the coil, and cannot readily be increased or reduced to any great extent according to requirements. It is in this respect that hydraulically- and pneumatically-operated clutches have advantages to offer, since the compressive force exerted on the discs is proportional to the pressure of the oil or air applied. Generally, hydraulic clutches have a less speedy response characteristic, by reason of the comparatively sluggish nature of the pressure medium, but air-operated clutches do not suffer from this drawback.

Brief mention of Ortlinghaus clutches has already been made in MACHINERY (95/1106—25/11/59 and 97/495—31/8/60) in connection with the 6th European Machine Tool Exhibition and the International Machine Tool Exhibition at Olympia, 1960, and in the latter article, reference was made to a compact 18-h.p., 16-speed gearbox which incorporates a number of the company's Sinus electro-magnetic clutches. This box is noteworthy for its neatness and small overall dimensions in relation to the power transmitted and the number of output speeds obtainable. It incorporates three shafts only, the end bearings for which are carried in steel discs of such a diameter as to circumscribe the periphery of the largest gear on each shaft. With this arrangement, the complete box can be assembled as a "cartridge" into a machine base, for example, with the output and input shafts projecting so that suitable connections can be made.

An example of the application of Ortlinghaus hydraulic multi-disc clutches is afforded by the close-up view shown in Fig. 1. This figure shows a plan view of the headstock of a turret lathe, with the main cover removed so that the clutches, which provide for a range of spindle speeds, can be clearly seen.

CLUTCH PLATES—DESIGN AND MATERIALS

It is generally recognized that, from the standpoint of wear, hardened steel clutch plates are preferable for multi-disc clutches, but this arrange-

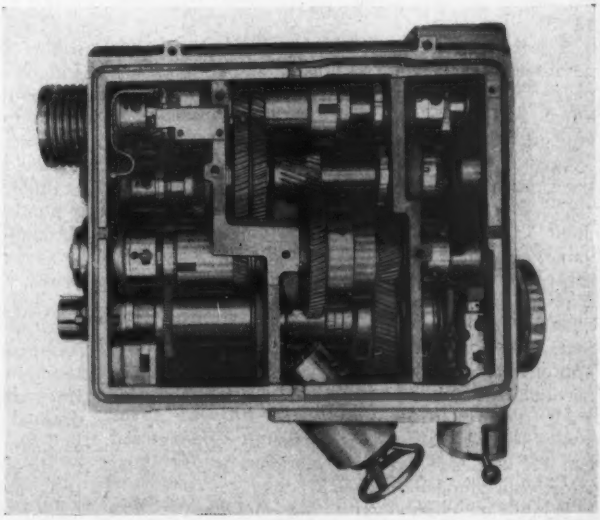


Fig. 1. Plan view of the headstock of a turret lathe, with the main cover removed to show the Ortlinghaus hydraulic multi-disc clutches

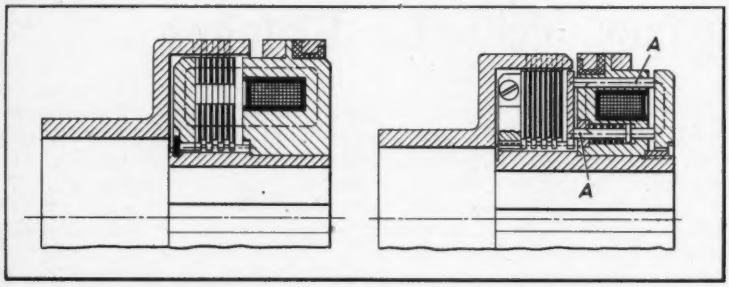


Fig. 2. The two basic types of Ortlinghaus electro-magnetic clutches are here shown in section. At the left is seen the magnetically-permeable type, in which the field passes through and beyond the plates, and at the right, the non-permeable type

ment may have one important disadvantage. When running in oil, it is sometimes found that the work-polished surfaces of the hardened plates tend to adhere, and this condition is unacceptable in transmissions where immediate and complete disengagement of a drive is of prime importance. Separation of the discs can sometimes be expedited by the provision of springs, which are arranged to "open" the stack when the operating pressure is removed, and an alternative is to provide saucer-shaped discs that are squeezed flat when the clutch is engaged and resume their free form on disengagement.

A feature of Ortlinghaus clutches is the incorporation of "corrugated" discs, known as Sinus plates, which are interspersed with the conventional flat plates. When operating pressure is applied, the corrugations are compressed, but "reassert" themselves, to separate the plates, when the pressure is removed.

For a transmission in which the major requirement is the maintenance of a constant friction value, combined with good resistance to wear, and regardless of variations in speed and operating temperature, the company has developed a facing material known as Konstant. It is stated that this material can operate at high temperatures without appreciable change in friction value, and it is particularly intended for applications where heavy loads require to be accelerated but the space available for clutch units is restricted. The material can be used for dry-plate clutches, or for those which run immersed in oil.

When a clutch with non-metallic friction material is specified, the company can supply units with Ortex plates. This material is intended for operating in direct contact with cast iron or steel, and there is a range of qualities and types of the basic material, which can be supplied as pads, strips, or segments, for bonding or riveting in position. It is stated that Ortex friction facings will operate satisfactorily at temperatures up to 600 deg. C.

ELECTRO-MAGNETIC CLUTCHES

There are two basic types of Ortlinghaus electro - magnetic clutches, namely permeable and non-permeable, and part sections through typical clutches of these types are shown at the left and right, respectively, in Fig. 2. Obviously, the permeable type (left) must incorporate metallic plates, and it will be noted that the magnetic field, indicated by a chain dotted line, passes through, and extends beyond, the stack of discs. To the left of the stack there is a plain pressure ring, which is also within the magnetic field, and this ring serves to apply the pressure to the discs as it is attracted to the coil. Clutches of this type are distinguished by the code name ELDU.

The arrangement for a non-permeable clutch (right), designated ELMEK, is somewhat different, and it will be seen that the discs lie outside the magnetic field, which, again, is indicated by a chain-dotted line. The pressure ring of this type of clutch lies to the right of the coil, and within the field, and when the coil is energized this ring is pulled axially to the left. As a result, it abuts a number of sliding plungers, as at A, which pass through bores machined in the coil housing and project to the left. Here, there is a thinner pressure ring, and when the plungers are moved to the left this ring is moved also, to compress the stack of discs. Some of the plungers are provided with compression springs, which serve to return them to the right when the coil is de-energized, the outer pressure ring being thus restored to its original position.

Type ELMEK clutches can be faced with any of the friction materials previously described, and provision is made for pre-setting the transmitted torque, by means of a screwed ring which adjusts the clearance between the discs in the stack. These clutches are claimed to be particularly suitable for the type of feed drives which are provided on heavy machine tools, for example.

HYDRAULICALLY-OPERATED CLUTCHES

A sectional view of a typical Ortlinghaus hydraulically - operated multi-disc clutch installation is shown in Fig. 3, where it will be seen that the clutch shell has a reduced-diameter portion to which a gear is keyed. Pressure oil to engage the clutch is delivered by way of the port *B* and is directed, through further ports in the clutch body, to the right-hand side of the piston *C*. The bore of this piston is arranged to slide on an enlarged portion of the clutch body, and its periphery within a cylinder member *D*, which is secured to one end of the body. Conventional seals are provided to prevent the escape of oil at both these sliding surfaces.

When oil is admitted to the right-hand side of the piston *C*, the latter is moved to the left, to compress the stack of discs, the thrust applied, and the torque transmitted, being proportional to the pressure of the oil. To disengage the clutch, oil pressure is released from the piston *C* and directed to the port *E*. Compression springs, as at *F*, return the piston *C* to its original setting, and oil from the port *E* is discharged between the plates, to ensure that they are completely separated.

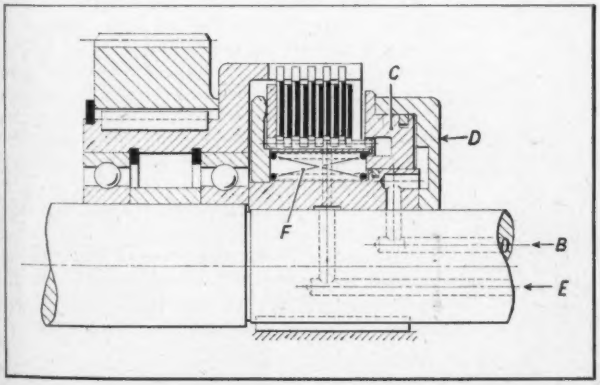


Fig. 3. Sectional view through an Ortlinghaus hydraulically-operated multi-disc clutch installation. Pressure oil is delivered from a special large- and small-volume pump unit, the output from the large pump being automatically diverted once the clutch has been engaged

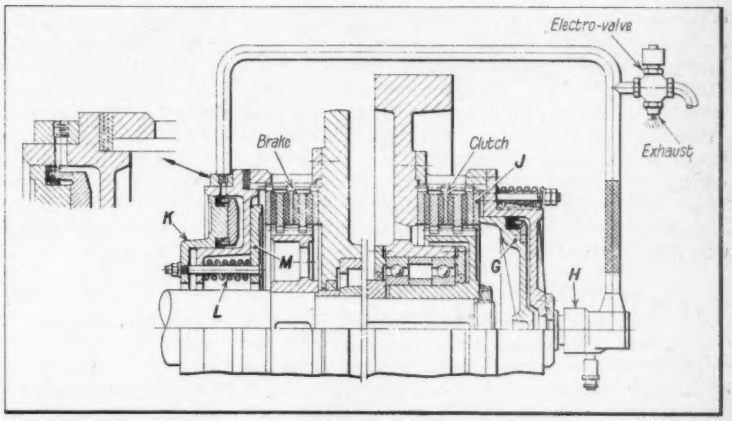


Fig. 4. An Ortlinghaus pneumatically-operated clutch and brake unit is here shown in section. Pressure to compress the plates in the brake section is applied by springs, and the brake is held in the disengaged position by air pressure on the piston *K*

Pressure oil to operate the clutch is provided by a special unit, which is supplied by the company and comprises a large- and a small-output gear pump arranged in one casing. To engage the clutch, the outputs of both pumps are directed to the piston *C*, and with this arrangement a large volume of oil is made available to ensure rapid operation. Once the clutch is engaged, however, a pressure-sensitive valve in the circuit cuts out the delivery of the large pump, leaving the smaller unit to maintain pressure on the plates. The minimum energy is thus expended to maintain engagement of the clutch, and the oil remains at a lower temperature than would be the case if both pumps were in continuous operation, and a larger excess volume was discharged through a relief valve.

These clutches are provided with hardened and ground steel plates, interspersed with Sinus discs, and it will be appreciated that an inherent feature of the design is automatic

compensation for wear. If there is any reduction in thickness of the plates in service, the piston *C* travels a slightly greater distance before engagement takes place. Mention has already been made of the slight time lag which may occur with hydraulic clutches, owing to the relatively sluggish nature of the pressure medium, and it is therefore recommended that they should not be employed where a very rapid response is essential. They are claimed to be very suitable, however, for main drives to machine tools.

PNEUMATICALLY-OPERATED CLUTCHES

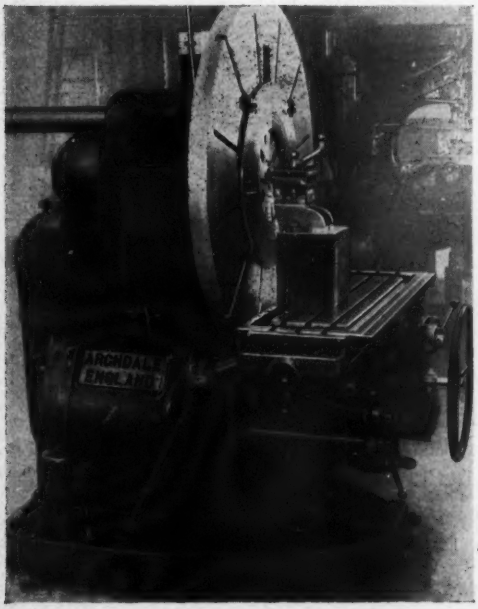
A sectional view of a pneumatically-operated Ortlinghaus clutch and brake unit, as may be employed in the transmission of a crank press, for example, is shown in Fig. 4, where it will be seen that the basic operating principle is similar to that of a hydraulically-operated unit. The clutch section, at the right, is actuated by the large-diameter piston *G*, air being admitted to the right-hand side of this member by way of the running connection *H*. As the piston moves to the left it thrusts a pressure ring *J* against the stack of plates, to compress them. The ring *J* has a number of threaded studs which are arranged to slide through the casing of the clutch and carry strong compression springs. When air pressure on the piston is released, these springs pull the pressure ring *J* to the right. The clutch plates are thus released, and at the same time the piston *G* is returned to its original position.

A somewhat similar arrangement is provided for the brake section of the unit, at the left. In this instance, however, air is admitted to move the piston *K* to the left, to release the brake. To apply the brake, the air supply is cut off, and the piston *K* is thrust rapidly to the right, by the springs *L*. On the right-hand ends of the studs carrying these springs there is a pressure plate *M*, whereby thrust is transmitted to the stack of discs in the brake section.

The outer shell of the brake unit is secured to some fixed part of the machine—for example, the press frame—so that when the plates are compressed the drive shaft is rapidly brought to rest.

Milling Machine Adapted for Boring Operations

At the Quebec, Canada, factory of Foxborough Co., Ltd., special equipment has been provided to enable accurate boring operations on large-diameter orifice plates for flow meters to be performed on a 20-in. horizontal production milling machine built by James Archdale & Co., Ltd., Blackpole Works, Worcester. The need for installing a lathe of the necessarily large swing capacity has thus been avoided and the equipment can readily be removed from the machine when it is required for normal milling work.



Archdale milling machine with special equipment for accurate boring operations on orifice plates. The adaption avoided the need to purchase a large-swing capacity lathe

It was found that with the overarm retracted, the machine will swing a diameter of 40 in. and an aluminium faceplate was made for mounting on the spindle nose, as seen in the figure. A swivel toolpost is bolted to the machine table, and to facilitate accurate setting for the diameter of the work, a hand-wheel with 0·0001-in. graduations is provided for longitudinal adjustment of the table.

With this arrangement, the bores of large plates can be held to the specified tolerance of 0·001 in. The plate shown in the illustration is of ¼-in. thick stainless steel and is bored to 8·493 in. diameter.

Production of Bolt-head Trimming Dies by Intraforming

THE INTRAFORM PROCESS and various equipment for internal forming (see MACHINERY, 95/152—29/7/59) have been introduced comparatively recently by the Meta-Dynamics Division of the Cincinnati Milling Machine Co., U.S.A., and one of the first of these machines to be used for commercial production is installed in the works of the Howell Gear Co., Howell, Mich. This company supplies trimming die inserts of the form shown in Fig. 1 to numerous customers. Made from M 2 and M 3 high speed steel, these dies are employed on bolt-making machines for trimming hexagon heads. Normally, cold forming operations are employed in order to save work material, but in this particular application, although there is some economy in expensive high speed steel, the principal advantages are the reduction in tool costs and the speed with which the hexagon bore inserts are produced, as compared with the alternative of broaching.

PRINCIPLE OF OPERATION

A general view of the 200-ton capacity machine is given in Fig. 2, and Fig. 3 is a close-up view showing the mandrel on which a hollow cylindrical blank for a die insert is about to be placed in position. The mandrel corresponds to the cross section shape required in the work bore, and when the blank has been loaded, the mandrel slide is advanced by the two large-diameter screws to carry the work between four forming dies in the head at the left.

These dies are carried on holders, each of which has a cam surface in the form of a sine curve at the outer end. As the die holders are rotated about the work axis, the cam surfaces are in contact with a series of hardened steel rollers which are free to rotate on fixed axes. In operation, the cam surfaces are always in contact with the rollers so that no hammering occurs. A pulsating motion is however imparted to the dies which thus exert a squeezing action as they rotate about the work and cause the bore to conform to the cross-sectional shape of the mandrel.

Contact with the rotating dies causes the work and the mandrel to turn but at a somewhat lower speed. At the same time, the work is fed along the mandrel towards the rear end of the machine head. Because the work is traversed and the mandrel remains stationary after it has been advanced to the operating position, long parts can, if required, be formed with short, comparatively inexpensive mandrels.

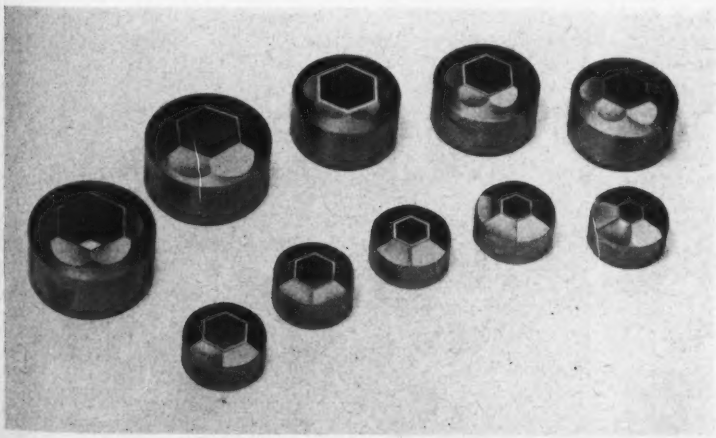


Fig. 1. Examples of bolt-head trimming dies with hexagon bores produced by the Intraform process

For the die inserts shown in Fig. 1, the mandrels and the squeezing dies are made from M 2 or M 3 high speed steel, hardened to 60-62 Rockwell C. It is stated that with hand loading of the blanks, an output of 150 trimming die inserts per hour can be obtained. If provision were made for automatic blank feeding, however, the number could be increased to 300 per hour. When the dies leave the machine, the surface finish in the bores is often of the order of 2

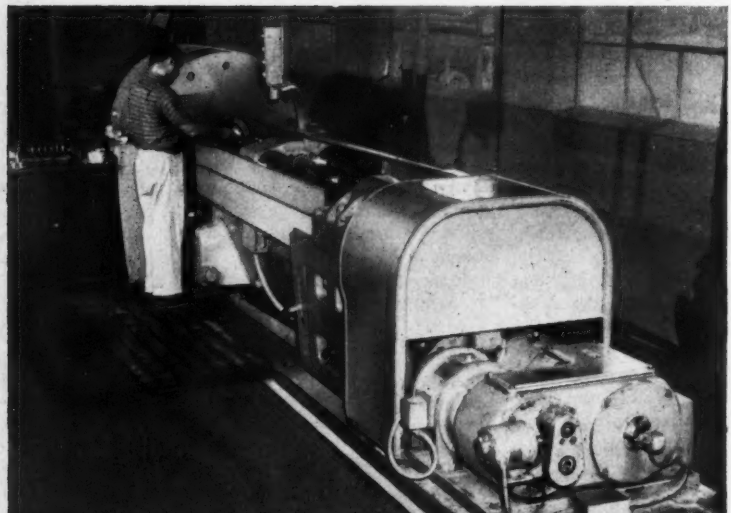


Fig. 2. This 200-ton Intraform machine is installed in the works of the Howell Gear Co., U.S.A.

micro-inches, but the quality of surface is affected to some extent by subsequent heat treatment.

Finally, the inserts are ground on the rear faces and outside surfaces, and the front faces are finished to the form shown in Fig. 1, to provide cutting edges.

INTRAFORMING VARIOUS MATERIALS

Apart from the trimming die inserts, numerous materials and parts have been Intraformed experimentally by the Howell Gear Co., and some examples are shown in Fig. 4. In addition to high speed tool steels, operations have been carried out on various gear and shaft steels, several series 300 stainless steels, zirconium, Inconel, Hastelloy, brass, copper, phosphor-bronze, and aluminium alloys. Such combinations as steel within brass, and copper within aluminium, have also been formed, and it is stated that good bonding can be obtained at the interface. The outside surfaces of workpieces must be circular, but need not necessarily be cylindrical. It is believed, for example, that it will be possible to produce tapered barrels, complete with rifling grooves.

The internal cross section need not be symmetrical, as will be apparent from some of the examples in Fig. 4, nor need the section be uniform throughout the length. In the centre of the illustration, for instance, is seen a sectioned splined sleeve coupling for a farm tractor, which has three different internal cross sections. Previously, this component was produced by broaching splines in three short lengths of tubing, and welding them together. By the Intraform method, the sleeve is made from one length of tubing in 30 sec.

When parts which require a considerable reduction in cross sectional area are to be made from some materials, it may be desirable to complete the operation in two stages with intermediate anneal-

Fig. 3. A close-up view showing a blank for a trimming die about to be placed in position on the hexagon mandrel

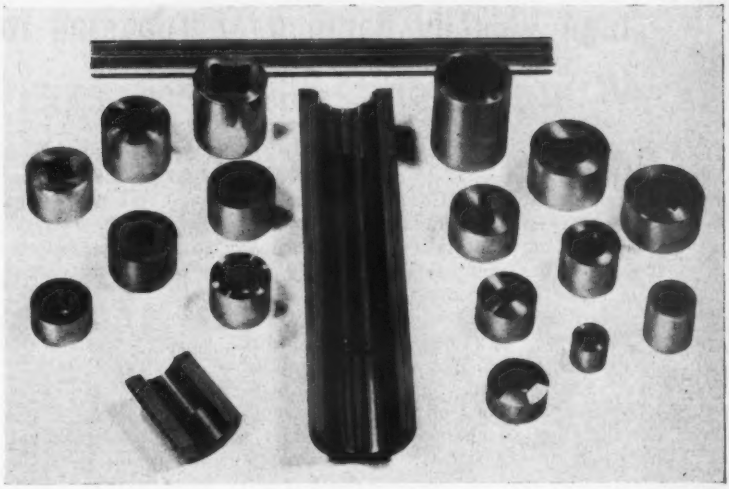


Fig. 4. Some examples of parts produced experimentally by the Intraform method

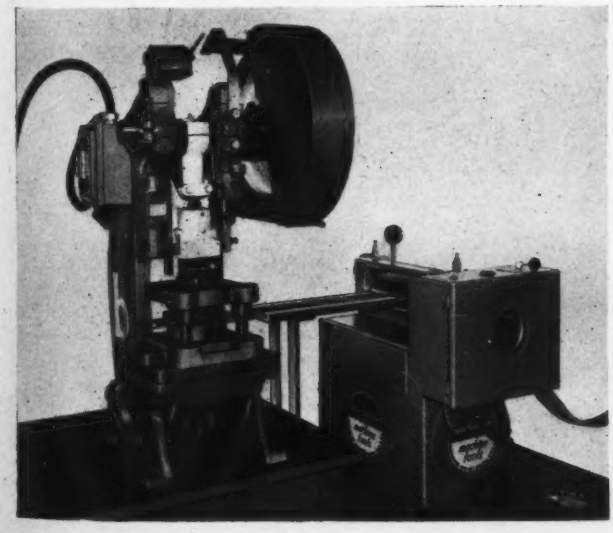
ing. In general, moreover, the success of an Intraforming operation depends on the selection of the most suitable initial bore size, as determined by experience and accurate control of the blank weight. It is also necessary to employ blanks of such proportions that the amount of cold working will suffice to ensure that optimum grain formation is provided in the structure of the finished part.

Fatigue life of tool steel can be substantially improved by the process, and hardness and tensile strength are both increased. It is found, moreover, that comparatively little distortion occurs if Intraformed parts are machined or heat-treated.

Benchmaster Motorized Strip Feed Unit

The MAF unit shown in the figure has been introduced by Benchmaster Manufacturing Co., U.S.A., for feeding strip material to presses or other machines. It incorporates a friction type roll feed arrangement to which drive is transmitted, by way of a constantly running flywheel and solenoid-operated clutch/brake unit, from an electric motor. An adjustable control can be set for feed lengths which normally range from 3 to 60 in. and can be held accurate to $\frac{1}{32}$ in., or less, and the standard speed of feeding is 50 ft. per min. Other feed length ranges and speeds can, however, be provided if required.

The feed unit can be tripped manually, or can be controlled automatically from the associated machine, and a portable switch with 12 ft. of cable is provided. Units are made in various sizes to handle stock up to 12 in. wide by $\frac{1}{8}$ in. thick. Flat material or coiled stock can be fed, and special rolls can also be supplied for round bar.



Benchmaster motorized feeding unit for strip stock in increments from 3 to 60 in.

High Velocity Forming of Tungsten for Structural Applications

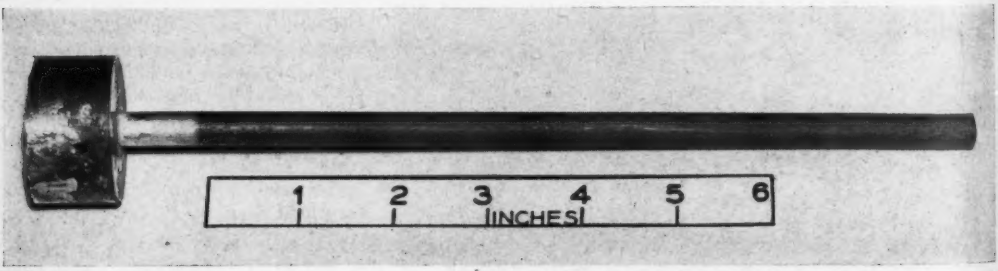
FORMING TECHNIQUES based on the use of the Dynapak process, developed by the Convair Division, General Dynamics Corporation, Pomona, Calif., U.S.A., it is reported, are likely to extend the use of tungsten as a structural material. Because of its strength at high temperatures (there is only a small falling-off in the strength of the material even at temperatures as high as 4,000 deg. F.), tungsten has proved extremely difficult to work into shapes which are capable of resisting sudden shocks and loads. Tests conducted on high-velocity Dynapak extruding and forging machines have indicated that if the metal is formed at a sufficiently high speed, extensive grain refinement occurs, with a striking improvement in ductility and consequent toughness. Moreover, area reductions have been achieved which far exceed those previously obtained.

Dynapak machines were described in MACHINERY, 96/705—7/10/59, and reference was made to the application of this technique in MACHINERY, 97/398—17/8/60. The Dynapak process makes use of the energy stored in a large volume of air at high pressure, which acts initially on a small area and is held in balance by a volume of air at lower pressure acting on a larger area. A ram associated with the high pressure air is thus maintained in a "ready to fire" condition, and is triggered by a slight increase in the higher air pressure. Machines can be built with energy levels as high as 1,500,000 ft.-lb.

In a series of tests on tungsten billets conducted by the U.S. National Aeronautics and Space Administration, for example, a reduction of 8:1 was the best that could be obtained, using a standard extrusion press with an operating speed of approximately 150 in. per min. In order to obtain even this level of reduction, it was found necessary to enclose the billet in a columbium jacket, and to use a lubricant composed of powdered glass and graphite. In contrast, when Dynapak forming was employed, reductions up to 45:1 were obtained without the need for cladding the work material or the application of lubricant.

Tungsten billets are usually formed by powdered metallurgy techniques or, more recently, by arc melting in a controlled atmosphere. With either method, a large-grain structure normally results, and the accumulation of impurities along the grain boundaries produces lines of weakness. The high softening temperature of tungsten renders it impracticable to follow the usual procedure adopted for other metals with similar structural conditions, whereby the metal is hot-worked to break up the large grains and cause recrystallization into a finer-grain structure.

Low velocity extrusion of tungsten normally flattens out the large grains with no reduction in average crystal size. When it is subjected to high-velocity extrusion, however, the tungsten reforms into much smaller crystals. Planes of weakness that may be present are thus broken up, and a material of much greater ductility and toughness is obtained. The accompanying figure shows an extrusion that was produced on a high-velocity Dynapak machine. The original billet was 1¼ in. diameter by 1½ in. long, and the extruded portion of the workpiece shown is ⅜ in. diameter by 9⅛ in. long, so that the reduction ratio was approximately 11:1.



This tungsten extrusion was produced by the Dynapak process from a billet of 1¼ in. diameter by 1½ in. long. The extruded portion is ⅜ in. diameter by 9⅛ in. long

DIE CASTING SUPPLEMENT

Gravity and Pressure Die Casting at the Works of Thomas Ashworth & Co., Ltd., Burnley

By R. E. GREEN, Associate Editor

IN AN ARTICLE which was published in MACHINERY, 98/205—25/1/61, reference was made to the factory, converted from a cotton mill, which has recently been occupied by Thomas Ashworth & Co., Ltd., at Sycamore Avenue, Burnley. The main activity of this company is the making of gravity and pressure die castings in aluminium and zinc alloys. Some 14,000 castings are made per day, with the factory working two shifts, and the weekly consumption of metal is of the order of 16 tons. This article is concerned with further examples of castings, the dies in which they are produced, and auxiliary operations performed in the factory.

Some examples of castings made in the foundry are shown in Fig. 1, including—at the upper left—a switch box for an armoured vehicle, produced by the gravity process. The projections and cored apertures in the sides of this casting are produced by sliding cores, and the projections at each side of the switch-mounting positions on the top surface are formed in one die face. The three castings at the centre and top right are all pressure cast from aluminium alloys, and are representative of an extensive range supplied to a well-known manufacturer of attachments and accessories for use with portable drills.

At the lower left is an instrument mounting bracket, also in aluminium, and next to it, two castings for radar equipment which will be discussed later. The die for the aluminium impeller near the centre in the lower row was produced by spark erosion, as described in the previous article, and the three remaining castings are of zinc.

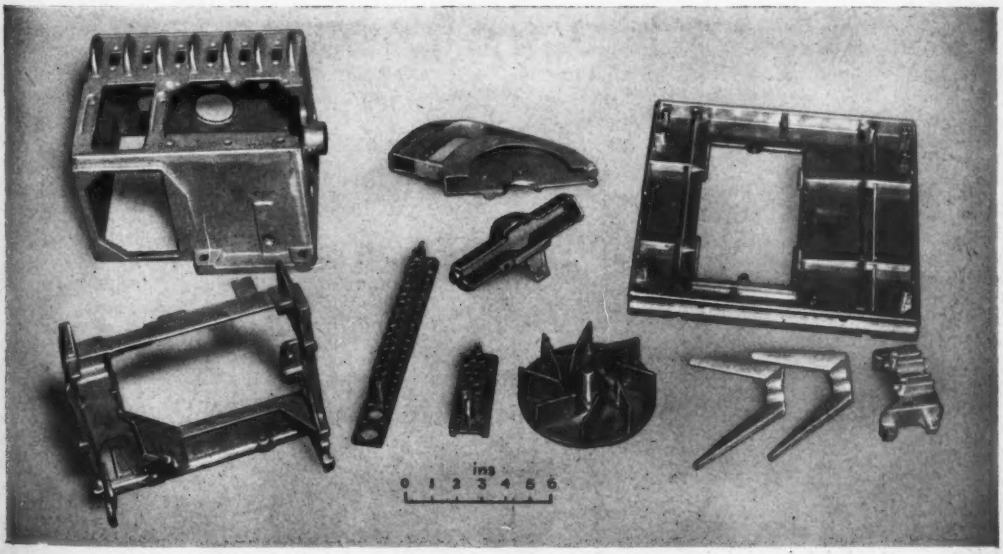


Fig. 1. Some examples from the wide range of pressure and gravity die castings made in aluminium and zinc alloys by Thomas Ashworth & Co., Ltd., in their factory in Burnley

CORE-PULLING CYLINDERS

Because of difficulties associated with the mounting of standard hydraulic core-pulling cylinders and interchanging them between dies, the company has designed—and now makes—a range of cylinders for this purpose. Examples of these cylinders are seen on the die in Fig. 2, from which it will be noted that each has an end-piece in the form of a substantial steel block, with lugs at each side. These lugs are about 1 in. thick, and they extend along the full width. Similar lugs are provided on the die bolster in the example shown, or on blocks secured to the die when the latter is machined from a single piece. When any cylinder is to be fitted to a particular die it is held in place by a pair of steel plates.

One of these plates is seen at *A*, and it has a shallow groove, of rectangular section, just large enough to embrace the lugs on the die and the cylinder block. Counter-bored holes are provided in the plates, in positions corresponding to tapped holes in the blocks and bolster, for the insertion of socket screws. During core withdrawal movements, the force exerted by the end of the cylinder is spread over a fairly large flat face on the side of the die block, and during casting, the thrust on the core is shared between the steel plates.

The die shown in Fig. 2, produces three small castings, in L.M. 6 aluminium alloy, for use in a surveyors' level. The largest casting, seen at the far side of the die body, has a long cored hole with a 3½-in. portion on which the taper is 30 min. on all sides, and the core slide at the left, which forms this hole, has a withdrawal movement of 5 in. Another, box-shaped casting, seen near the right-hand side of the die face, measures 4½ by 1½ by ½ in., and has a slot in one side which is cored by a projection on the slide at the right. Both core slides are locked in position, when the die is closed, by large-diameter pins. This die is used on a Reed-Prentice 1½ G machine.

Fig. 2. The method of attaching interchangeable core-pulling cylinders to pressure die casting dies is here illustrated. This particular die is employed for the production of castings for surveying instruments

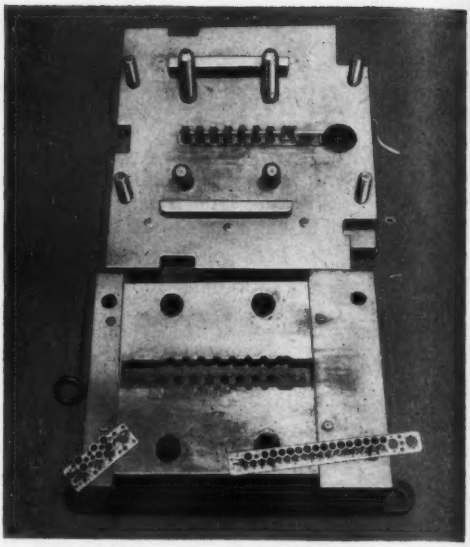


Fig. 3. In this view of the two halves of the die for the production of the larger of the two castings shown, from L.M.6 material, the alternate arrangement of the cores for the cylinder bores may be observed

DIE FOR A RADAR CASTING

The larger of the two radar castings seen at the left of the impeller in Fig. 1 is produced in the die illustrated in Fig. 3, from L.M. 6 alloy, and measures 11½ in. long by 1½ in. high,

the width of the base-plate portion being 1¼ in. More details of the casting may be seen in the close-up view, Fig. 4, and it will be noted that each of the 17 cored cylinders has a small wedge-shaped projection at each side, at the top. Such projections are more clearly seen at the tops of the cylinders on the smaller casting, which was made in a die of generally similar arrangement. The flat base of the casting, with which the cylinders are integral, is about ⅜ in. thick, and each side of this base is cast with a V-section groove, which leaves very thin edges.

These edges were often incomplete when the die was operated on a machine commensurate with its surface area, and it was therefore transferred to the 400-ton Bühler machine, mentioned in the previous article, on which injection pressures up to 15 tons per sq. in. are obtainable. This high pressure proved to be sufficient to ensure that the thin edges were fully filled before the metal solidified. Core pins in the fixed and moving die members produce the holes in alternate cylinders in the large casting, and the V-grooves in the base edges are formed by projections on the core blocks at the sides of the moving die, seen in the foreground in Fig. 3.

Each of these core slides is advanced and retracted by two cam pins, and is locked in position, when the die is closed, by a long steel block, let into the fixed die member. The die is bottom-gated, and there is a long runner bar which extends for the length of the cavity. In-gates lead from this bar into the die cavity through the openings at the ends of the cylinder cores. The runner bar is subsequently removed by face-milling the upper ends of the cylinders, leaving a casting weighing only 4 oz. Sleeve-type ejectors only are employed, and they surround the eight core pins in the moving half of the die. Including those which form the cylinder bores, the casting has a total of 101 holes produced by coring.

The company produces large numbers of cast aluminium components for washing machines for several well-known manufacturers, and the process

Fig. 5. Extracting a washer top casting, in L.M.2 alloy, from the Bühler 400-ton machine. When trimmed, the casting weighs 1 lb. 11 oz., and the die also produces two smaller castings, which are seen attached to the runner at *C*

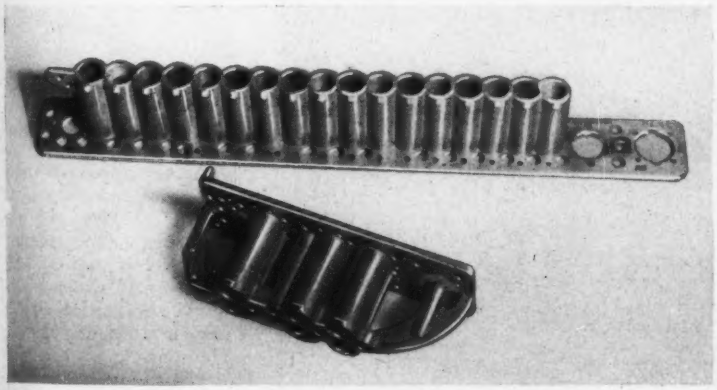


Fig. 4. Close-up view of the radar castings shown in Fig. 3. There are V-grooves in the edges of the base-plate, and to ensure sharp corners, a high injection pressure is employed

employed depends on the quantities and the rate of output required. For the washing machine top frame casting, seen being extracted from the die in Fig. 5, which is needed in numbers sufficient to warrant the use of pressure casting, the Bühler 400-ton machine is used. The casting is made from L.M. 2 alloy, and weighs about 1 lb. 11 oz. after trimming. It has dimensions of 16 in. square by approximately 1 in. deep overall, and incorporates a machined brass insert at *B*, to provide a bearing for the hand-operated agitator shaft.

In addition to the frame casting shown, two other small castings are produced in this die, in two cavities adjacent to the main runner bar, as indicated at *C*. These castings fit into apertures in the frame, to form bridges for the subsequent assembly of the lid and wringer of the washing machine. The casting cycle for this spray occupies 59 sec., but additional time is required for loading the insert and lubricating the die. Other washing machine die castings include a housing for a hand-operated wringer, which is also produced on the Bühler machine, and a number made by the gravity process.

A gravity die for a washing machine top frame casting is seen in Fig. 6, together with the casting, which is of L.M. 2 alloy and weighs 6½ lb. when trimmed. The die is mounted on a framework built up from steel sections, with rectangular holes cut in the webs for the insertion of the tines of a fork-lift truck, to facilitate handling. On this frame, the central portion *D* of the die, carrying the cam clamps mentioned in the previous article, is fixed. This portion of the die has an aperture about 18 in. square, in which the outside faces of the casting are formed.

Front and rear faces of the casting, which is about 3½ in. deep overall, also the internal walls, are formed between the two sliding members, one at each side of the fixed portion. The sliding member at the left carries pins which are engaged by the cam clamps when the die is closed, and is advanced and retracted by an air cylinder of 6 in. diameter, mounted on a fixed buttress at the end of the frame. At the right there is a core member which forms the approximately 12-in. square aperture in the casting, and is advanced and retracted by means of a rack and pinion. Rack teeth are cut in a flat surface machined on the top face of the 11½-in. diameter cylindrical plunger carrying the core. These teeth are engaged by a pinion, integral with a shaft which is turned by means of the bar *E*.

As explained in the earlier article, the cam clamps, when released, serve to open the die for about 1 in. After the die has been opened in this manner, the air cylinder is energized to withdraw the left-hand member to the position shown. A side core for a slot, operated by a lever at the far side of the die, is next retracted, and the core member at the right is then withdrawn, carrying the casting with it. As the core is moved to the position shown, a plate carrying ejector pins is arrested by the end of the housing for the cylindrical plunger, and the casting is thus stripped from the core.

Fig. 6. General view of a large die for gravity casting the washing machine top shown, which weighs about 6½ lb. when trimmed. A large air cylinder provides for the movements of the left-hand portion of the die

PEDESTAL CASTING DIE

Another example of a gravity die is shown in Fig. 7. This die is employed for casting pedestals from L.M. 20 alloy, one of which, with runners still attached, is seen in the foreground. The portion of the die at the right is fixed to the bench top, and has ears at each side with pins which carry lever-operated clamps. These

Fig. 7. This gravity die, designed for casting pedestals has interlocking cores for the tapered tubular portion and the box-shaped end. A casting is seen in the foreground

clamps are turned, when the die is closed, to bring them into contact with cam faces on matching ears on the other portion.

As may be seen, the casting takes the form of a tapering tube, with a diameter of 4 in. at the larger end, joined to a box-shaped member measuring 4 in. square by about 1 in. deep, and weighs 1 lb. 3 oz. without the runners.

A core for the tubular portion is suspended by a steel cable and a counterweight above the die. There is a thin end-piece on this core, which engages a bore in the square core for the box end of the casting. This latter core is carried in the fixed portion of the die, and it is advanced and retracted by means of the lever *F*, through a linkage arrangement.

BIPEL CLIPPING PRESS

Equipment installed in the fettling shop for operations on die castings includes the 30-ton capacity Bipel hydraulic clipping press shown in Fig. 8. Built by B.I.P. Engineering, Ltd., this machine has a maximum working area of 26 by 16 in. between the four tie-bars, and the maximum daylight is 32 in. The machine works on an automatic cycle during which the upper platen is moved down by a pair of accelerator rams, one on each side of the central main ram. At a pre-set height, this main ram, which has an area of 21·65 sq. in., is supplied with hydraulic oil at a pressure of 1,000 lb. per sq. in., and with this arrangement a force of about 9·6 tons can be applied for the clipping operation.

A reciprocating-type intensifier mounted above the platen can be switched into the circuit if desired, and the force applied is then increased by a factor of two or three, depending on the work to be performed. The press can be operated at about four strokes per min., and is here being employed for clipping the flash and over-flows from the washer top casting made on the Bühler machine in Fig. 5.

In this department, it may be mentioned, are also installed Bliss and H.M.E. crank presses, air-operated presses, and small toggle type presses for hand operation, also back-stand abrasive belt machines, band-saws, barrelling equipment, and other machine tools.

Fig. 8. Equipment installed for clipping operations in the fettling shop includes this Bipel hydraulic platen-type press. The machine is fitted with an intensifier whereby the force exerted by the main ram can be increased to 30 tons

Automatic Unloading Arrangement for a Die Casting Die

By C. C. BATT, Jnr*

AT THE WORKS of Rochester Products Division, General Motors Corporation, Rochester, N.Y., U.S.A., several Reed-Prentice machines and the dies employed on them are being modified to eliminate the usual manual removal of castings. The zinc-alloy castings which are being made on these machines are components for motor car carburetters.

The most advanced of the mechanized units is the type 1½ Reed-Prentice machine shown in Fig. 1, which is employed for casting venturi clusters. At each shot, two parts are produced in the die which are connected by runners to a hub. The spray is then unloaded automatically, the castings are cut from the gates, and the sprue and runners are returned to the holding pot for remelting.

No substantial changes were required to the actual dies themselves to adapt them for the new mechanized casting process. They are of the unit or insert type and are made, as seen in Fig. 2, to fit mating recesses in the bolsters. One die is located above and one below the sprue hole at the centre of the bolster.

To provide for automatic unloading, lateral recesses are formed in the bolster faces adjacent to the sprue hole, in which a socket is cast around the end of the unloading arm. This arm is pivoted at its centre on a supporting shaft, which corresponds to a vertical of the letter T. At the end of each arm, deep slots are milled on two diameters, and serve to anchor the socket when the metal solidifies.

In the casting position, the end of the arm projects into the recess, and the metal shrinks on to it. When the die is opened, ejector pins expel the complete spray from the moving half in the normal manner. At the same time, the unloading arm on its shaft is moved forward relative to the moving die.

After ejection has been completed, the whole spray is clear of the die, and is supported by the end of the unloading arm. Next, the shaft—powered by a small compressed air motor in the platen—is indexed through 180 deg., to swing the arm and the spray clear of the dies—to the cutting off position. At the same time, the opposite end of the T-arm is brought between the dies. The shaft retracts as the die closes, and this end of the arm takes up the same position in the die as was occupied by the other end during

* Rochester Products Division, General Motors Corporation, U.S.A.

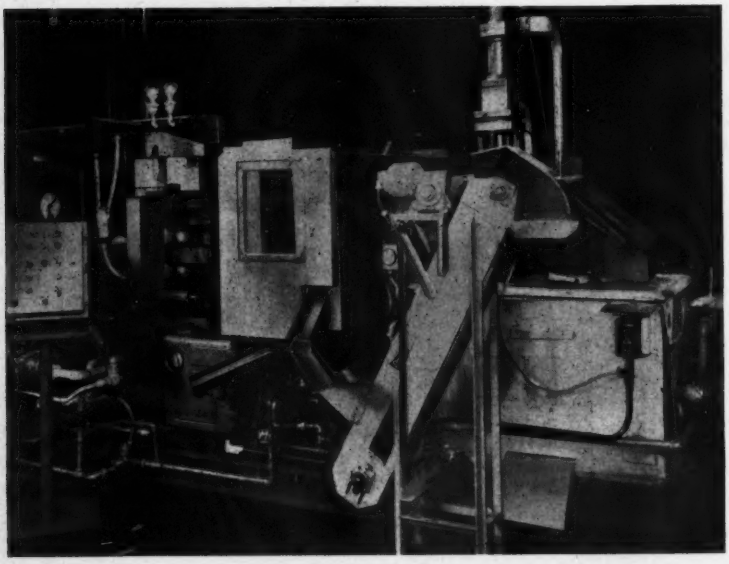


Fig. 1. Fully-mechanized Reed-Prentice die casting machine. Castings slide down chutes and fall through the guards. The scrap is returned to the melting pot by way of the elevator conveyor at the right

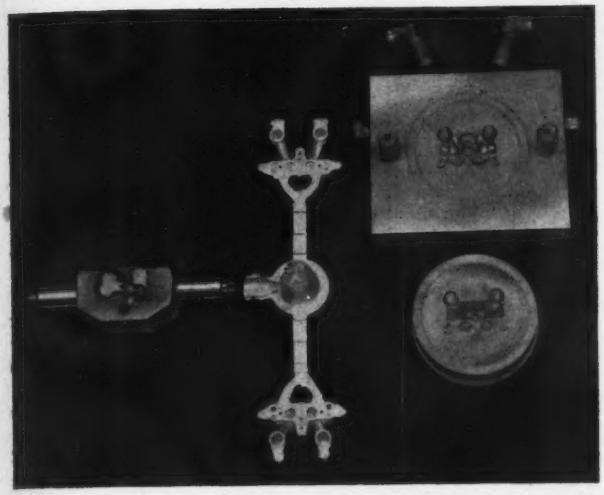


Fig. 2. The fixed portions of a pair of unit dies. In the centre is a spray of venturi castings, and at the left the unloading arm. A socket integral with the central sprue is cast around the tapered end of this arm

the previous cycle. Fig. 3 shows the die open, with the spray of castings supported on the arm near the cutting-off position after being indexed through 180 deg.

As the die closes, the runners are trapped between shearing knife edges on the side of the moving die bolster and a pair of cutting-off blocks on the fixed platen as indicated in the diagrammatic perspective view in Fig. 4. The two castings are thus sheared from the runners, and the lower piece drops into a chute, the upper casting being blown into a separate chute by an air jet. The scrap centre portion, comprising the sprue, runners, and socket, is left on the end of the arm, whence it is now stripped by an air-operated plunger, and falls into another chute.

At the end of the cycle, the arm end thus cleared is indexed through 180 deg. again and enters the recess in the die in readiness for the next shot. Thus the ends of the arm are used alternately to transfer the sprays out of the dies and into position for cutting off.

The scrap slides off the chute on to a short belt type elevator that runs continuously and discharges into a chute leading to the metal pot. The metal is kept at proper casting temperature by the gas-fired furnace which is a part of the machine. More heat is supplied than is usually required for holding purposes because the scrap must be melted. Castings from the machine are transferred to a trimming press for the removal of flash.

Although the machine set-up described is fully automatic, it is not expected to operate indefinitely without attention. It is planned that one operator should tend a group of machines. The machine is provided with a spray-type automatic die lubricator and electrical interlock circuits to control the automatic cycle, prevent damage to the machine, and avoid risks to the operator as a result of faulty functioning. Thus, if a casting or a part of the runner sticks in the die, or if the die does not close completely, the machine stops and an indicator light is illuminated. The machine cannot then be re-started until the cause of the interruption has been remedied.

Extending back from the movable platen there is a plunger connected by a rack and pinion to a converted cam timer. This timer operates a series of limit switches that control

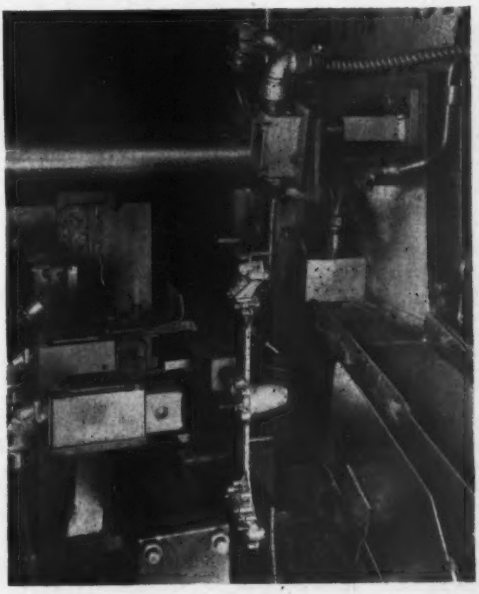


Fig. 3. The dies are here shown open, with a spray of castings in position for trimming. The casting sheared from the top runner is blown by an air blast into the chute at the right

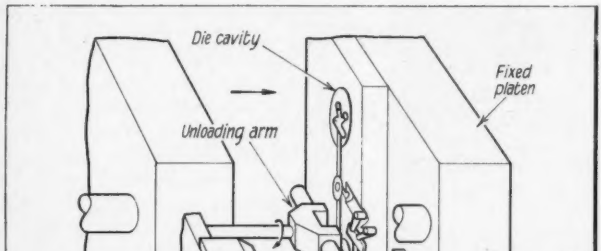


Fig. 4. Diagrammatic sketch showing the die open and the casting supported on the unloading arm. As the moving die on the left advances, it closes on the far end of the arm, to which the next spray will be attached

stages of the cycle. If any one of the interlocking switches fails to function, the machine stops until the fault has been corrected. This system is mainly concerned with the newly introduced automatic features. The original interlocks for the actual machine cycle are unchanged, except that the manual starting button is used only for setting-up and starting after a shut-down.

To avoid possible risks that might arise if the presence of flash, a sticking casting or some other obstruction should prevent the dies from closing completely, various special controls have been provided to supplement those commonly used on die casting machines. One safety device involves an unusual application of two Moore air gauge indicators.

These indicators are operated by air which is supplied at low pressure and are connected by small tubes to passages with openings at several points on the parting faces of the dies. When the dies are fully closed, the openings are shut off and back pressure builds up in the system and is indicated by the gauges. The back pressure is interlocked by way of valves with the electrical controls that permit injection to take place. If an obstruction prevents complete closure, the sequence controls do not function and the cycle is interrupted.

There is also a safety control that checks for removal of the castings from the die. This automatic check is made by means of two spring-actuated limit switches which are closed by contact with the two castings after the unloading arm has indexed and just as the die starts to close. If the switches have not closed by the time the die has moved through a set distance, the normal sequence is interrupted, the die opens, and the machine is stopped. A flashing red light then indicates that a casting is stuck in the die.

Any two unit die pairs that will fit the bolster can be used. Each cavity may be the same, or the two may be different. The set-up was designed primarily, however, to make venturi clusters of several different patterns. Each cluster has several cored holes, but all the core pins are at right angles to the die parting. Side or angle cores could, however, be used if required, provided that they did not interfere with the unloader-arm mechanism.

Safety in Pressure Die Casting

A set of three reports under the above title will shortly be published by the Safety Sub-Committee of the Zinc Alloy Die Casters' Association (Z.A.D.C.A.), 34 Berkeley Square, London, W.1. The reports, which will be available free from the above address, deal with safeguards for pressure die casting machines, fire hazards in die casting operations, and safety in die setting.

The report concerned with safeguards for pressure die casting machines first outlines the inherent difficulties of adequately guarding such machines during operation, and lists the main hazards which include trapping of the operator between the dies or other moving parts of the machine; burning by metal ejected from between the die faces; and the bursting of incompletely solidified slugs when the die is opened, on cold-chamber type machines. These dangers, and some examples of precautions which may be taken to guard against them, were considered at some length in MACHINERY, 93/1003—29/10/58.

Among the safeguards discussed in the report are the provision of mechanical means for preventing the dies from closing unless the guards have

been closed, and the fitting of an exhaust valve which is mechanically operated when the guards are opened to ensure that fluid pressure can only be directed to the die-opening side of the actuating cylinder. On direct-hydraulic machines, it is suggested, the use of such an exhaust valve might serve to simplify the design of the mechanical strut erected between the opened platens. General considerations relating to the design of guards, which serve to prevent both trapping and burning accidents, are also covered.

As regards machines for operation under automatic cycle control, it is considered that the system should be so designed that the various movements can be completed only in strict sequence. For interlocking mechanisms, reliance should not be placed on springs or gravity for the force required for movement to the safe position, but they should preferably be positively operated mechanically. The only complete safeguard against the accidental operation of the die-closing or injection-operating valves, it is contended, is to provide an interlocking mechanism attached to the sliding guard, which governs the use of both these valves. Where pilot valves are employed to operate die-closing or injection valves, they should be mechanically interlocked to prevent out-of-sequence movement in the event of pilot valve or pipe-line failure.

The report recommends that the wiring of limit switches, and of solenoids employed in the machine control circuits should be so arranged that, in the event of failure of the supply, the mechanisms will be left in, or will assume a safe position.

FIRE HAZARDS IN DIE CASTING OPERATIONS

Sources of risk of fire in a die casting foundry include the molten metal, the melting and holding furnaces, the hydraulic units, and the electrical equipment. The fire risk from molten metal is obvious, although it varies somewhat with the temperature and the specific heat of the metal or alloy. Spurts of molten metal from an improperly-closed die have been known to set fire to dust which had been allowed to accumulate in the roof. Such splashes can be prevented by efficient guards, but dust which is ordinarily inaccessible should be removed at least once a year. Bench tops should be of metal rather than wood, and the use of wooden duckboards is not recommended.

Serious accidents may be caused by careless feeding of ingots to melting or holding furnaces, and regulations to ensure that metal fed to furnaces is clean and dry should be strictly enforced. Electric resistance and induction furnaces are comparatively safe, and with modern gas firing and the provision of adequate pilot lights, there is little risk. With an oil-fired furnace, however, there may be danger if the cut-off valve fails to work when the air-blast is interrupted. Oil may then be allowed to flow into the hot combustion chamber and vaporize, with the risk of explosion. Melting pots should be placed within dams which will retain the metal if the crucibles should break.

Petroleum-based oils in hydraulic units operating near furnaces introduce a serious fire risk. The oil-stream escaping from a pin-point leak in a pressure pipe line can form a highly-inflammable mixture with the surrounding air, and should this mixture become ignited by a naked flame or the hot metal in a furnace, a dangerous fire can result. The risk is greatest with cold-chamber machines used in conjunction with bale-out furnaces, since for a hot-chamber machine the furnace is usually situated away from the hydraulic unit and pipe lines. Several satisfactory fire-resistant hydraulic fluids are now available, which will give good service in systems designed for use with oil.

The danger of electrical fires can largely be overcome by the use of flameproof apparatus and switchgear, made to B.S. 229, tested, and certified. Wiring which may be subjected to mechanical abrasion or pressure should be armour-sheathed, and to meet conditions of heat or oil contamination the sheathing should be selected accordingly. Shop workers should be instructed in the use of the correct fire-fighting appliances since the application of water in the wrong circumstances can have catastrophic results. Assistance can be had in this connection, from the local fire brigade, and free advice on fire protection can also be obtained from the Fire Protection Association, Garrard House, Gresham Street, London, E.C.2.

Advice on fire protection and allied matters is also published by the Ministry of Labour; free pamphlets are obtainable from H.M. Inspectors of Factories.

SAFETY IN DIE SETTING

Recommendations concerning the safety precautions to be adopted during die setting operations, when trapping accidents sometimes occur, are directed towards the establishment of safe practices, and are not intended to be an interpretation of the Factories Acts of 1937 to 1959 covering the fencing of dangerous parts of machinery. The setting of die casting machines should be carried out only by men who have been trained both in die setting and in safety precautions, and workers under 18 should be employed for this task only under close supervision.

Power should normally be switched off except when the platens are to be moved, and these move-

ments should be performed only at slow or inching speeds, so that they can be stopped immediately by the release of the button or in some other manner. Dual controls, requiring the use of both the operator's hands, should be provided, and a normal, full stroke of the platen should never be made without the splash guards in position. On large machines, safe footholds should be provided on which fitters can climb when it is required to make adjustments.

On dies, sharp edges should be chamfered to prevent cuts on hands, and both the spigot on the fixed platen and the bore of the die should be chamfered to facilitate alignment during fitting. Attention should be paid to the handling of dies when they are being fitted to or removed from a machine, and mechanical aids should be provided where possible, and care taken that they are correctly employed. Tools, chains, slings, and pulleys employed for lifting should be carefully handled, and dies should be marked with their weights to ensure the use of sufficiently strong equipment. Attention is drawn to the provisions of B.S. 529/1944, Steel Eyebolts; B.S. 781/1950, Wrought Iron Chain Slings; and B.S. 1290/1958, Wire Rope Slings and Sling Legs; in connection with mechanical handling.

On steel eyebolts, for instance, the British Standard specifies that the collar under-surface should be smooth and flat. The surface of the die should be in the same condition, and at right angles to the tapped hole which should be a good fit on the eyebolt thread. Periodic critical examination of eyebolts is recommended, and they should be scrapped when there is evidence of wear or damage to the threads, or appreciable bruising of the eyes.

"Fluidized-bed" Furnace for Treatment of Airframe Parts

To facilitate uniform heating and cooling of aircraft and missile components, which are required to operate under exacting conditions, a new type of "fluidized-bed" furnace has been developed by the Aero-Space Division of the Boeing Airplane Co., Seattle, Washington, U.S.A., It is stated that furnaces of this type, in connection with which patent applications have been lodged, are already in operation at the company's development centre, and at the works of the Transport Division in Renton, Washington.

The furnace operates on a principle similar to that employed for "roasting" pyritic ores. A "fluidized-bed," which forms the floor of the chamber, is composed of very small refractory particles, of accurately controlled shape and size range, resting on a diffusion plate. In operation, a stream of air or inert gas is directed upwards through the diffusion plate and into the bed under a pressure sufficient to support the weight of the particles and keep them in suspension. Under the action of the air or gas, the bed bubbles and swirls like boiling water and the turbulence ensures uniform and rapid transfer of heat or cold. In the illustration, a component is seen partially immersed in the bed of an experimental furnace. It is stated that temperatures ranging from +2,000 to −110 deg. F. can be obtained, as required for the heat-treatment of various steels, cobalt- and nickel-base alloys, and other alloys for service at high temperature. When withdrawn from the bed, the work-pieces have clean surfaces, free from adhering particles.

As an indication of the quenching capacity of such a bed, it is reported that a small metal part, heated to 600 deg. F., was cooled to about 200 deg. F. in 5 sec. Rapid quenching, it is pointed out, is due partly to the absence of vapour formation around the surface of the work, as occurs initially when heated work is immersed in liquid.

An experimental "fluidized-bed" furnace. Work is rapidly heated or quenched in a mass of small refractory particles through which air or gas is forced

Diskus Twin-spindle Surface Grinding Machines

Diskus Werke, A.G., Frankfurt-on-Main, West Germany, have recently supplied a number of machines with twin spindles, for grinding, simultaneously, two faces of components for boilers.

The type DDS 1000 machine, shown in Fig. 1, has two vertically opposed grinding spindles mounting 40-in. diameter wheels. Workpieces measuring up to 60 by 27½ in. and from 2¼ to 4¾ in. thick can normally be ground, but if required, provision can be made for thicknesses from 3⅛ to 5½ in. Each grinding spindle is driven by a motor of 52 h.p. through V-belts, and the heavy-duty wheel spindles are mounted in anti-friction bearings which can be adjusted to take up radial and axial play.

Individual hand adjustment is provided for the spindle quills, for putting on the cut, and power traverse is available for retracting the quills, for example, for changing the grinding wheels. The traverse motor is automatically switched off when the quills are fully withdrawn. Coolant is delivered to the working area through the hollow upper grinding spindle by an impeller pump, from two tanks with a combined capacity of 660 gal.

Boiler members are loaded on to rollers at the left-hand end of the machine, and are traversed between the wheels by two pairs of driven rollers coupled by universal-joint shafts to a steplessly-variable transmission unit. The two upper rollers are adjustable vertically to suit the workpiece thickness, and there are adjustable side guides to ensure straight travel of the work towards the wheels. Each workpiece is fed between the grinding wheels by the following piece, which is traversed by the driven rollers. Another set of rollers supports the finished piece as it emerges from the wheels. All rollers are of hardened steel and mounted in anti-friction bearings.

The grinding wheels are dressed by means of a diamond truing device which is fed between the wheels and then reciprocated by the driven rollers.

For grinding larger boiler components, up to a maximum size of 71 by 39 in., and from 4 in. to 8 in. thick, the type DWH 1600/2000 machine shown in Fig. 2 is available. This machine has two independently-driven horizontal spindles whereon are mounted 63-in. diameter grinding wheels, and the workpiece is clamped hydraulically. When the "start cycle" button is pressed, the table is traversed to the working position, at a speed of 40 ft. per min. Immediately the work touches the wheels, the speed is automatically reduced to the feed rate, which is adjustable from 3 and 10 ft. per min. The component is passed through the wheels and returned, and when it is clear, the fixture is withdrawn at rapid traverse to the unloading position. To prevent the fixture from tipping during grinding, the upper frame member is designed as a rail which passes between four guide rollers above the grinding heads.

Hydraulic swivelling loading and unloading fixtures can be provided to facilitate handling heavy workpieces. The loading fixture brings the component to the correct position in the grinding fix-

Fig. 1. Diskus type DDS 1000 twin-spindle surface-grinding machine with roller feed, for boiler components

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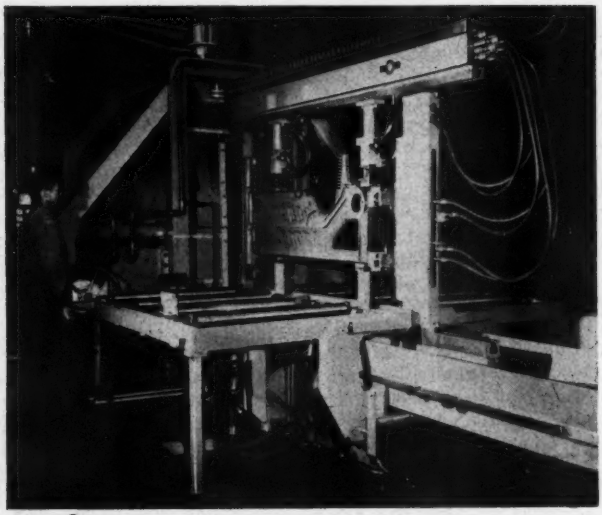


Fig. 2. Diskus type DWH 1600/2000 horizontal-spindle surface grinding machine, with hydraulic fixture, for boiler components

ture, where it is clamped, and then returns to the horizontal setting, as seen in Fig. 2. For unloading, there is a similar fixture located at the opposite side of the machine bed.

Many other components of similar type, such as machine side frames, can also be ground on these machines.

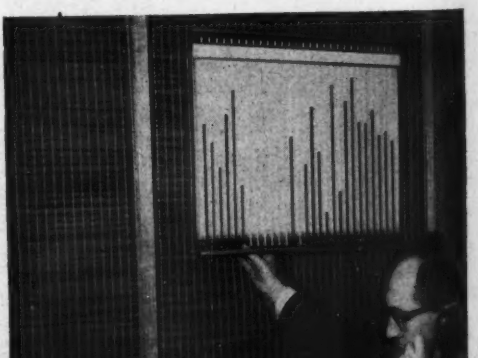
The sole agents in this country for Diskus Werke, A.G., are Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2.

Dia-Plan Planning Chart

The accompanying illustration shows the Norwegian-made Dia-Plan planning chart, which is now being marketed in this country by Badenia Calculators, Ltd., Lion House, 72 Red Lion Street, London, W.C.1. Designed to record such data as output, stocks, and sales, in an easily read and adjusted form, the unit measures 24 by 22 in., and has 28 endless bands of plastics ribbon, each band forming one bar of the chart. Bands of plastics ribbon can be supplied with one half white and the other half either red, blue, green or yellow, and the unit can be mounted with the bands vertical or horizontal.

Each plastics band passes over a transparent plastics control wheel on a spindle at each longer edge of the unit, and one run of the band is above a sheet of graph paper, which is secured to the main panel of the unit with special clips. A detachable paper strip is held in an indicator bar along one edge of the panel, and serves for identifying each column, also the units and other data. Movement of the bands is effected by rotating one of the control wheels, and it is stated that this operation can be readily carried out with one hand, as seen in the figure.

At the end of each period covered by the chart, the final positions of the coloured portions of the plastics ribbons can be recorded on the graph paper, with other relevant information, to form a permanent record, which is filed. To prevent accidental movement of the control wheels, and to protect the chart from dust, the unit is provided with a hinged transparent plastics cover.



Norwegian-made Dia-Plan planning control chart with columns of movable plastics ribbon

Automatic Loading on a Red Ring Gear Shaver

Automatic loading and unloading equipment has recently been designed and built by Precision Gear Machines & Tools, Ltd., Red Ring Works, Bodmin Road, Wyken, Coventry, for use on a type GCU 12-in. universal diagonal gear shaving machine. This equipment, which is seen standing in front of the machine in Fig. 1, is designed for loading and unloading camshafts for the 4-cylinder engine of the Victor passenger car made by Vauxhall Motors, Ltd., Luton, and is shortly to be installed in their factory. When the installation has been completed, the machine will form part of a completely automated line for the production of camshafts.

The operation performed on the machine is the shaving of the gear near the centre, which drives the distributor and oil pump shafts, and this gear, of 1·599-in. pitch diameter by ½-in. face width, has 13 teeth of 14 d.p., 20 deg. pressure angle, and 54 deg. 30 min. left-hand helix angle.

With the automatic loading equipment, camshafts can be delivered from the previous machine in the line, and passed on, after being shaved, to the next machine, or they can be supplied and removed manually. The transfer mechanisms or magazines, whereby the camshafts are indexed to the loading, and away from the unloading positions, are similar, except that they are of opposite hand, and a view showing the loading unit at the left in Fig. 1, from the far side, is given in Fig. 2. Each unit has a fabricated steel framework covered with sheet metal panels, with bearings to support cross-shafts carrying roller chain sprockets.

Roller chains on these sprockets carry brackets with semi-circular grooves to support and locate the camshafts, and the shaft at the right-hand end is driven to index the components to the loading station. Drive is taken from the Mawdsley "stop clutch" motor *A*, and is transmitted through a worm and wheel to a Geneva mechanism within the circular housing. This arrangement enables the camshafts to be indexed with sufficient accuracy to ensure reliable pick-up at the loading point, and the conveyor can also be run in the reverse direction.

Some details of the loading equipment can also be seen in Fig. 2. The cast housing *B* contains a vertical hydraulic cylinder, the ram of which is secured at the bottom of the housing. An upward extension *C* of the body of this cylinder carries the pivoted loading arm, and at an intermediate point the cylinder is provided with pinion teeth which engage the teeth of a rack, cut on the ram of a horizontal hydraulic cylinder within the housing *D*. These two cylinders provide for raising and lowering the arm, and pivoting the arm through 90 deg. to and from the pick-up and loading positions. The movements of these cylinders, also those of other mechanisms on the machine, are interlocked by limit switches, the circuits through which must be completed before a further stage in the cycle can be initiated.

Additional details of the loading arm, which is

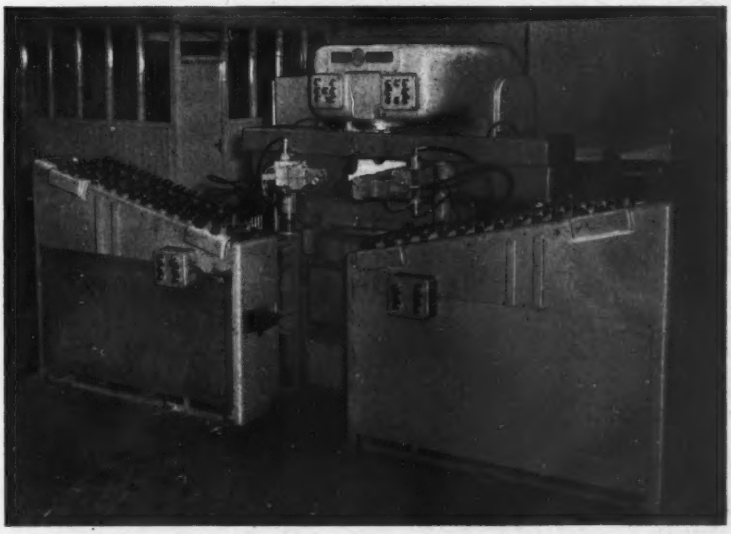


Fig. 1. General view of the Red Ring type GCU 12-in. universal gear shaving machine, fitted with automatic, hydraulically-operated, loading and unloading equipment, for a camshaft

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generally similar to that for unloading, except that it is of opposite hand, are seen in the close-up view, Fig. 3. From this view is will be observed that there is a third hydraulic cylinder, in the housing *E*, for operating another rack and pinion mechanism whereby the arm can be rotated about a horizontal axis through 90 deg. At the end of the arm there is a double bracket with cam slots in which there are two pairs of gripping fingers, so spaced that they can engage unmachined portions between the lobes on a camshaft. When the arm is turned by the cylinder in the housing *E*, these fingers are moved from the horizontal to the vertical position, or vice versa.

The fingers are connected to the ram of a small hydraulic cylinder *F*, and the cam slots in the brackets are so arranged that when this ram is drawn away from them, the outer ends of the fingers are moved inwards to grip the shaft. At the outer end, each finger has a V-groove, fitted with wear-resistant carbide pads, to provide positive location for the shaft.

At the start of the loading cycle, the arm is positioned above the camshaft in the lowest pair of carriers on the conveyor, and it is lowered by the cylinder *C*, Fig. 2, before the fingers are closed to grip the shaft. The arm is then raised and the fingers are rotated to bring them into a horizontal position, before the arm is pivoted to carry the shaft through the opening in the machine guard, into the loading position.

If the angular position of the cutter teeth is such that they mesh smoothly with those of the gear to be shaved, the cycle proceeds in the manner to be described. To prevent damage to the cutter should the teeth fail to mesh correctly, a pivoted jaw is provided on the lower of the two fingers nearer to the pivot point of the arm. This jaw is held in its normal position by a spring, which is not further compressed when the fingers are closed on a shaft, but will permit movement if the teeth of the cutter and the gear do not mesh. In these circumstances, a micro-switch is operated by the jaw, to complete a circuit which causes reversal of the direction of the oil supply to the cylinder in the housing *D*, Fig. 2. As a result that arm is moved away from the machine, to carry the gear out of contact with the cutter.

At the same time, the driving motor for the cutter is momentarily energized, to turn the cutter to a slightly different position, and an electric timer is started. After a short interval, determined by the timer, the direction of the oil supply to the arm-pivoting cylinder is again reversed, so that the camshaft is again carried towards the loading position. Failure of the teeth to mesh causes this cycle to be repeated until engagement is obtained, usually at the second or third attempt at the most, and the camshaft is then positioned with its axis in alignment with the axes of the supporting centres.

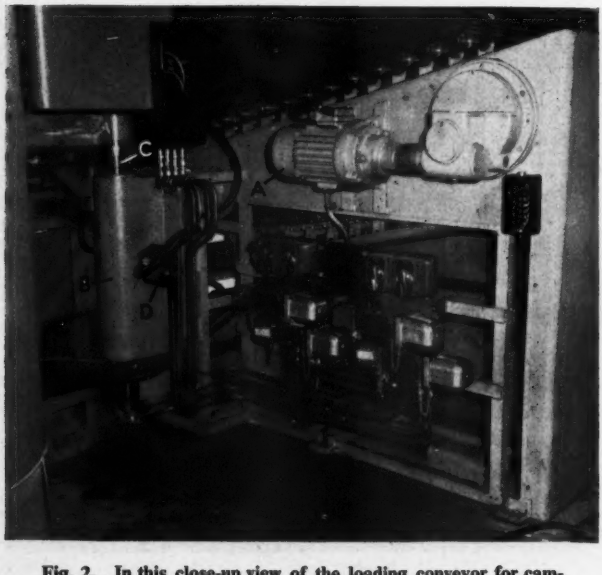

Fig. 2. In this close-up view of the loading conveyor for camshafts, the motor *A*, which drives the conveyor through a Geneva mechanism, and the loading unit can be seen. The latter has vertical and swivelling motions

As the arm is moved fully into the loading position a limit switch is operated, causing the supporting centres to be advanced by air cylinders, and locked. At the same time, air is supplied to another cylinder mounted on a housing for two support rollers, which are just visible through the guard opening in Fig. 3. This cylinder raises the rollers into contact with the centre bearing of the camshaft to steady it against the pressure exerted during the shaving operation.

With the shaft thus held, the gripping fingers on the arm are opened by reversing the direction of the oil supply to the small cylinder *F*, and the arm can then be turned to withdraw it from the loading position. When the arm has returned to its original position above the conveyor, the automatic cycle of the shaving machine is started, the first movement

being the closing of the guard. The cutter-driving motor is then started, to rotate the 8-in. diameter cutter at 300 r.p.m., and the table is fed upwards by an amount sufficient to take up the 0·025 in. of backlash allowed between the teeth of the cutter and the gear, for loading.

Next, the feed to the table is started, and two complete forward and return strokes are made, the direction of rotation of the cutter, and of the camshaft which it drives, being reversed at the end of each stroke. Finishing operations are thus carried out on both flanks of the camshaft gear teeth by the conventional crossed-axis method. A light oil is supplied to the cutter to lubricate and cool the teeth, and to carry away shavings, and the cycle occupies 38 sec. When the operation has been completed, the cutter-driving motor is stopped, the table is lowered, and the guard is opened automatically by its air cylinder.

The unloading arm, at the right-hand side of the guard opening, is next swung round towards the machine, and the gripping fingers are closed on the camshaft. The centres and the support rollers are retracted, and the arm is swung back to the unloading position above a pair of empty carrier brackets on the right-hand conveyor. Rotation of the arm now brings the fingers to a vertical position, and the arm is lowered to deposit the finished shaft on the conveyor.

As stated earlier, the entire operating cycle of the loading and unloading mechanism, which occupies a further 10 sec., is interlocked, but certain portions of the cycle, such as the picking up of a fresh camshaft at the loading side, are performed during the machining cycle. In addition, the driving motors and control switches for the loading and unloading conveyors are so wired that each conveyor can be caused to shuttle continuously in the event of a failure of the supply of components from the previous machine in the line, or if the operation of the shaving machine is temporarily interrupted. The object of the arrangements is to ensure that the machine can be kept supplied continuously, while there are any components on the conveyor, without idle cycles that would result from gaps.

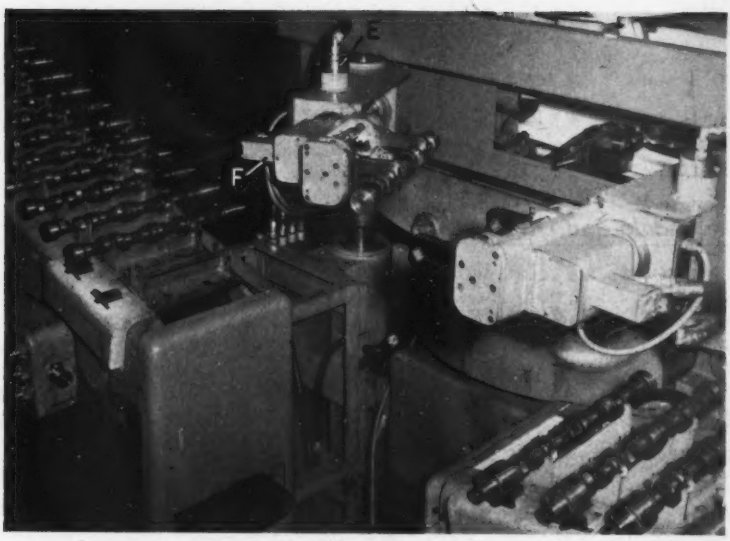

Fig. 3. Camshafts are picked up from the loading conveyor at the left in two pairs of fingers which are then turned through 90 deg. to bring them horizontal before the arm is swung round into the loading position

A camshaft is taken from the lower end of the left-hand conveyor by the loading fingers, as soon as the loading arm has been retracted after a loading operation has been completed, and one of the conveyor switches is operated. This switch causes the conveyor to index one position, to carry another part to the pick-up point. If a fresh part was not loaded at the upper end of the conveyor during the previous cycle, there will now be two empty positions at that end, and another switch will then cause the conveyor to run in reverse until there is only one empty place. The machine cycle continues, and if this empty place is filled, the conveyor will be indexed forward again, bringing another part to the pick-up position.

If another part is not loaded at the top of the conveyor, and another component is wanted at the end of the machine cycle, a switch on the machine causes the conveyor to run forward until the pick-up position is filled. When a shaft is picked up from this position, the conveyor will again run back until there is only a single empty

(*Continued on page* 463)

NEWS OF THE INDUSTRY

Rochdale and District

JOHN HOLROYD & CO., LTD., Holfos Works, Rope Street, Rochdale, inform us that they are very busy on bronze products, and that this applies particularly to the centrifugal department of the Holfos foundries. There has been a steady expansion in the output of shell moulded castings in recent months, capacity having been gradually expanded to keep pace with the growing demand. The Holroyd method of continuously casting long lengths of round bar and tubing has proved very successful, and this department is also exceptionally busy. A monthly stock list of available material is obtainable upon request.

The departments engaged in finish machining are fully occupied and we are informed that developments are continually taking place to enable the company to take full advantage of the latest machining techniques. Arrangements are now in hand for increasing the capacity of the foundries and the machine shop by bringing additional buildings into use.

Standard bushes are being made from Holroyd Holfos bronze by one of the associated companies, Billetop & Gilpin, Ltd., Victoria Road, Syston, near Leicester, and it is stated that satisfactory progress is being made in this connection.

THOMAS ROBINSON & SONS, LTD., Rochdale, are fully occupied with the production of their range of wood-working machines and equipment, also flour milling plant and machinery. The wood-working machinery department has recently booked an order for two sleeper adzers and borers for the Argentina State Railways.

New machines recently installed in the works include a Landis-Lund cylindrical grinder, an Asquith O.D.1. 6-ft. radial drilling machine, a Hunt drill grinding machine, and a Fokker-Eckold hand-operated cold forming machine. In addition, the following are on order: a Parkson universal milling machine, a Herbert 9C combination turret lathe, a Ward No. 7 capstan lathe, two Ward 2.D.S. capstan lathes, and a Kerry band type cutting-off saw.

FROST (ROCHDALE), LTD., Crawford Street, Rochdale, report a continued steady demand, from both the home and the export markets, for all machines in their range. Equipment seen in progress in the works included treadle guillotine shearing machines; adjustable circular shearing machines with capacities ranging up to 36 in. diameter by 16 gauge; folding machines; plate bending rolls; and overcrank guillotine shearing machines of various sizes.

JOHN HOLROYD & CO., LTD., Milnrow, report a keen demand for their range of single and double reduction gear units, also for their services as gear cutting specialists. In addition, there is a steady call for the company's milling machines, and a number of machines for rotor milling is at present in production in the works, the majority of which are destined for export to various countries. We are informed that in addition to building rotor

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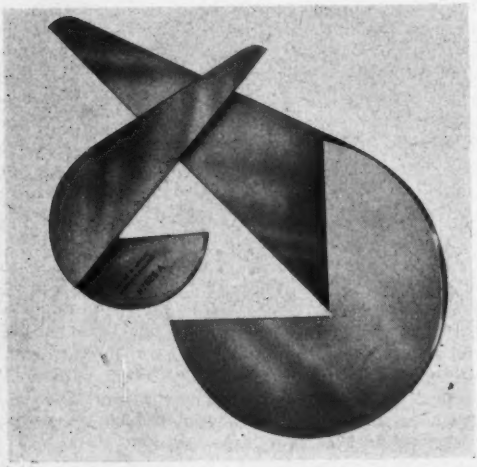
Moore & Wright (Sheffield), Ltd., Handsworth Road, Sheffield, 13, have recently introduced the two centre-squares shown in the above illustration. These tools are made from high quality tool steel, and have blades of hardened and tempered strip. The smaller size has a capacity for bars and discs up to 1½ in., and the larger, up to 3 in. diameter.



milling machines, this company undertakes a large amount of rotor milling, on a contract basis, for a wide range of customers throughout the world.

A works extension which is at present nearing completion will house the complete manufacturing facilities of the reduction gear section, and we hope to publish further details of this development at a later date.

The company is to exhibit examples of gearing, gear reduction units, and rotors, at the forthcoming Engineering, Marine, Welding and Nuclear Energy Exhibition.

DAVID BRIDGE & CO., LTD., Queensway, Castleton, are busy with the construction of their range of machines for the manufacture of a diversity of products in the rubber, plastics, and associated industries. The company's equipment is now being exported to many countries, and the U.S.S.R. is prominent on the list.

To enable the works to meet the increasing demand, re-organization is now in progress.

TAYLOR INDUSTRIAL CLUTCHES, LTD., Upper Trows Works, Castleton, inform us that they are experiencing a heavy and sustained demand for their range of wet and dry multi-plate clutch units and brakes. A steady call is also reported for pneumatic and hydraulic clutches and brakes in the standard series for use on presses ranging from 50 to 500 tons capacity, and for special types for presses up to 2,000 tons.

L. E. WILSON (DIE CASTING) CO., LTD., Trows Works, Trows Lane, Castleton, are busy with the production of high quality gravity die castings, for various customers, including a number of new lines. We are informed that in addition to constructing dies for use in the company's works, the toolroom undertakes die-making on a contract basis for other firms.

TURNER BROTHERS ASBESTOS CO., LTD., Spotland, report a sustained flow of orders for all their products, including asbestos textiles of various kinds, conveyor belting, and transmission belting of both the vee and flat types. The recently introduced Poly-Vee drive unit has had a very good reception from a wide circle of users.

A major development scheme is now nearing completion at the Rochdale works, and in order to keep pace with the rising volume of demand, some sections of the factory are now working on a 3-shift basis. Many examples of the company's products are to be exhibited on the Group stand at the Moscow Trade Fair.

PETRIE & MCNAUGHT, LTD., Crawford Street, Rochdale, report a continued request for their wide range of products which includes washing machines, carbonizing plants and drying machines for the textile industry; extruders and drying machines for chemical pigments; scrap metal baling machines; and grass and grain driers. We are informed that an illustrated display of the company's products will be staged on the Brameast Textile Machinery, Ltd., stand at the forthcoming British Trade Fair in Moscow.

R. SUTCLIFFE.

Yorkshire

J. PARKINSON & SON (SHIPLEY), LTD., Canal Ironworks, Shipley, report that the trading position has been satisfactory during recent months. A large volume of orders is now in hand for all the milling machines in the company's range, including export orders from Australia and South Africa. We are informed, moreover, that among enquiries recently received there have been many from Communist Bloc countries.

Orders for Sunderland gear planing machines are also well maintained. In particular, it is reported, a number of machines of the larger sizes is destined for Japan, South Africa, France, Australia, and Yugoslavia. It may be noted, in this connection, that approximately 50 per cent of current production is for export markets. The company is to exhibit a No. 2V milling machine at this year's Tokyo Fair.

Demand for Sunderland gear cutters is steadily increasing, and the number of orders received for various sizes of vices has lately shown a progressive rise.

JOHN ROBSON (SHIPLEY), LTD., Ives Street, Shipley, report that there is a sustained demand for their range of horizontal diesel engines from 11 to 150 h.p. The greater proportion of the output is for export to various markets, including Pakistan, Iran, Iraq, Thailand, the Philippines, and Saudi-Arabia.

This company is shortly to install a Kitchen-Walker E.2, 4-ft. capacity, radial drilling machine.

FRANK WIGGLESWORTH & CO., LTD., Saltaire, Shipley, are busy with the production of their range of power transmission equipment which includes Texrope V-belts and pulleys, centrifugal clutches, mechanically-operated clutches of both ring and multi-disc high speed types, and flexible couplings of a wide range of sizes and types. Among export markets, particular mention is made of the U.S.S.R.

The foundry is reported to be well occupied with various iron castings for use in the manufacture of the company's products.

SHIPLEY ENGINEERING CO., LTD., Shipley, report a continued demand for contract machining from various branches of engineering, including the machine tool and aircraft industries.

T. & W. H. CLARK, Perseverance Works, Shipley, inform us that there is a steady call for their plain horizontal milling machine, which is equipped with Vari-pitch driving pulleys to provide a steplessly variable speed range from 35 to 400 r.p.m.

ANDERTON SPRINGS, LTD., Clyde Street, Bingley, report a steadily growing demand for their range of standardized circlips. The programme of development and expansion which was begun some time ago has now been partially completed, and production capacity at the Clyde Street works and the Victoria works has been increased. In addition, heat treatment facilities have been augmented by the installation of two 30-kW. furnaces. Twenty-four-hour working is being maintained at the Clyde Street works. The alterations to the strip slitting and stock departments at Goose Eye works have been completed.

A new rapid circlip calculator known as the "Data-disc" has been produced. It provides all relevant information, from shaft sizes to thrust figures, for the type 1500 series E, C, U and S circlips, also the DIN. 6799 range.

DEE-KAY ENGINEERING CO., LTD., Victoria Works, Bingley, makers of jigs, fixtures, press tools and dies, report that to meet the heavy demands for their products, night shift working has been started. Plans are in hand for a new tool factory, and it is hoped that building operations will start in the near future.

FAIRBANK BREARLEY SONS & CO., Central Works, Church Street, Bingley, are experiencing a steady flow of orders for their range of spring making machinery, from both the home and export markets.

B. SMITH & SONS (SAW MILL ENGINEERS), LTD., Bingley, report a sustained demand for their range of woodworking machinery, and make special reference to the high percentage of orders at present in hand for export.

R. SUTCLIFFE.

Essex-Lovejoy Flexible Couplings

In the illustration is shown an example from the range of Essex-Lovejoy flexible couplings, which Motor Gear & Engineering Co., Ltd., Chadwell Heath, Essex, have recently started to make under licence from the U.S.A.

An example from the range of Essex-Lovejoy flexible couplings

These couplings are available in 11 sizes, the smallest of which, known as the type A.035, weighs only 1 oz., has an external diameter of ⅝ in., an overall length of ¾ in., and will transmit 0·003 h.p. at a speed of 100 r.p.m. A maximum of 60 h.p., at a speed of 3,600 r.p.m., can be transmitted by the largest coupling in the range, designated type L.225, which has an external diameter and an overall length of 6 in., and weighs 21 lb. A single-piece spider is interposed between the driving and driven member of each coupling, which will accommodate misalignment between parallel shafts, also angular misalignment up to a maximum of 1½ deg. Keyways machined to meet the requirements of B.S. 46:1958 are provided in driving and driven members with bores which exceed ¼ in. diameter.

F.B.I. Industrial Trends Enquiry

The results of the 10th enquiry into industrial trends, which relates the position at the end of January to that existing four months earlier, have been issued by the Federation of British Industries, 21 Tothill Street, London, S.W.1. In the two previous enquiries there was some falling off in the balance of "ups" over "downs" for "rate of total new orders." The latest survey shows a slight downward balance (26 per cent "up," and 31 per cent "down"). It was also noted that there had been a rather more significant fall in the length of order books (21 per cent "up" and 31 per cent "down"). As a result, "shortage of orders" has become the most important factor limiting expansion. The decline in orders applied

to consumption goods for the home market. Export orders, on balance, have shown no change, and orders for capital equipment are still rising. This latter trend is confirmed by the reported continued rise in intended investment in plant and equipment, despite apparent weakening in order books.

Output is reported to have risen on balance, but the margin was the smallest for any period in the past year. On balance, it is stated, labour is easier to recruit.

For the first time in the past year, there was an upward movement in the stocks of finished goods. Raw material stocks have continued to rise, contrary to expectation.

A combination of higher hourly wages and the rising prices of some materials and fuels, coupled with a steadier level of output, have led to the largest rise in costs per unit which has been noted since the enquiries began three years ago.

It is concluded that: "The continuation of the trend which is reported this time would produce a disturbing situation—falling orders coupled with rising stocks could lead to cut-backs in production and employment, while rising costs would jeopardise our export competitiveness." Although the general mood is of lessening optimism, however, the "detailed expectations give some hope that this trend may be halted."

Brighton Technical College

The annual ceremony for the distribution of prizes, diplomas, and certificates to students of the Mechanical and Electrical Engineering Departments of Brighton Technical College was held recently at Brighton, Sussex, with Mrs. M. G. Mills, M.A., past-chairman of the College governors, presiding. Dr. G. E. Watts, C.B.E., M.A., Ph.D. (Cantab.), B.Sc. (London), F.R.I.C., the principal, presented his report which included interesting statistics relating to the attendance of students, their achievements, and the subjects studied. At present, he said, the College was providing instruction for a growing body of students, including 960 who were taking full-time or "sandwich" courses, and 2,475 enrolled for part-time day and evening courses. These figures include 346 full-time and 566 part-time students in the Mechanical and Electrical Engineering Departments, where the field of instruction has been extended to include courses in production techniques, production planning, and work study.

Awards were presented by Prof. R. Hanbury Brown, B.Sc. (Eng.), D.Sc., D.I.C., A.M.I.E.E., F.R.S., a former student of Brighton Technical College and now Professor of Radio Astronomy at the University of Manchester. Among the recipients were 16 students who have gained the College Diploma in Electrical Engineering after being in the first group from Brighton to complete a 4-year "sandwich" course comprising alternating 6-month periods of instruction at the College and in industry.

Subsequently, in his address, Prof. Brown referred briefly to his work in connection with the use of radio telescopes for the investigation of problems concerned with the evolution and structure of the universe, and went on to say how, in his opinion, scientists and technologists could effectively extend their knowledge selectively, and thus gradually increase their value to society. A vote of thanks to Prof. Brown was proposed by Dr. E. Hughes, D.Sc., M.I.E.E., a former vice-principal of the College, and seconded by Mr. J. D. B. Petit, on behalf of the students.

Hepworth & Grandage Developments

Hepworth & Grandage, Ltd., St. John's Works, Bradford, inform us that their group of companies is busy with the production of a wide range of motor vehicle components including pistons,

Piston gauging equipment built by Thomas Mercer, Ltd., and installed in the works of Hepworth & Grandage, Ltd.

gudgeon pins, piston rings, and cylinder liners, also castings of various types, some of which are made by the shell moulding process.

A new factory is to be built at Sunderland, a 22-acre site having been acquired at Southwick for this purpose. Construction is to begin shortly, and it is hoped to start manufacture, with a labour force of some 350, by the end of the year. The first stages of the project will include the construction of a cast-iron foundry of some 165,000 sq. ft., for producing piston ring and shell-moulded castings, and an electric melting furnace and the latest automatic moulding machinery are to be installed. A machine shop with an area of some 72,000 sq. ft. is also scheduled for early completion.

A new automatic machine for checking pistons has recently been installed in the inspection department. This machine was designed and built by Thomas Mercer, Ltd., in conjunction with the company, and a close-up view is shown in the accompanying illustration. In operation, pistons are loaded by hand at the point *A*, whence they are automatically transferred through two groups of inspection stations. Automatic discharge of rejected components takes place at the two points *B*, and pistons which are passed as acceptable at all the gauging stations are delivered at *C* on to a table. This installation has a capacity for 600 pistons per hour.

A view showing the interior of the Eclipse mobile demonstration unit

Eclipse Mobile Demonstration Unit

James Neill & Co. (Sheffield), Ltd., Napier Street, Sheffield, 1, have available a mobile demonstration unit, in the form of a 17-ft. trailer which is towed by a Land Rover estate car. As seen in the accompanying illustration, the trailer carries a full range of magnetic chucks, including the latest "Permanent-Electro" type, also various magnetic aids to production. A variety of workpieces is provided, many of which are representative of difficult jobs which must be handled in production shops and tool rooms.

This unit provides for practical education in the principles of magnetic tools and their correct application in production engineering, and comprehensive demonstrations are given by the field engineer in charge. Instruction can be given to sales staffs of distributors, and staffs of training establishments. In addition, the unit will visit production plants under arrangements made by appointed distributors.

Apart from the demonstration facilities which it affords, the unit is equipped with both film and slide projectors for instructional purposes. We are informed that the unit has already completed a successful Continental tour. Further particulars of the service offered are obtainable from the company at the above address.

Patent Die-Castings Co., Ltd.

The Patent Die-Castings Co., Ltd., Strode Road, Willesden Green, London, N.W.10, inform us that they have acquired the Lightalloys factory in Park Royal which the Manganese Bronze & Brass Co., Ltd., are vacating, and expect to move to these premises during the next two months. This step will be part of a major programme of expansion and modernization, whereby the company's two existing foundries, which produce a wide range of castings in aluminium and zinc, will be combined in a single unit. The space available at the new premises will permit installation of additional and larger die casting machines, and the ancillary departments and services will also be extended. Certain of the buildings on the site will not be required and are for disposal.

A new office block with a frontage on Chase Road will be built and when these new arrangements have been completed, a total of 95,000 sq. ft. will be occupied.

The company is now under the direction of a newly-formed board comprising Mr. S. L. Fellows (chairman), Mr. L. A. Jarvis (managing director), Mr. S. R. F. Hickman Mr. R. D. Poore, and Mr. A. J. W. Payne.

Fisholow Exhibits for Moscow

Fisholow products from the range made by Fisher & Ludlow, Ltd., Material Handling Division, which will be exhibited at the British Trade Fair, in Moscow, were displayed recently at the company's works at Birmingham New Road, Tipton, Staffs. The firm's stand at the Fair will cover an area of 800 sq. ft., and the principal exhibit will be a Flowmaster overhead conveyor system, arranged for fully automatic operation under the control of punched tape. Part of this system, as set up for demonstration at the Tipton works, is shown in Fig. 2, and in Fig. 1 may be seen, from left to right, the teleprinter unit for tape preparation; the combined control unit, indicator panel, and tape reader; and a cabinet representing a paint spraying booth, through which sheet metal components are passed by the conveyor. Elsewhere in the installation, provision is made for other components, on which machining operations would normally be performed, to be automatically removed from the conveyor by a hydraulically-operated transfer unit, and lowered on to friction drive rollers, representing a machine tool. At the end of a pre-set delay period, corresponding to a cycle time for machining, the transfer unit is reversed for raising the component clear of the rollers and returning it to the conveyor for movement to another part of the system.

With the Flowmaster system, components of

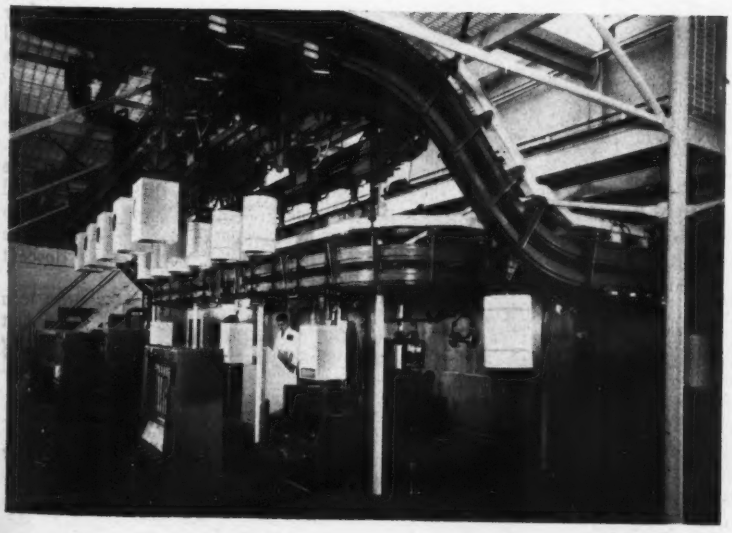


Fig. 1. View showing the teleprinter and control unit which form part of the Flowmaster conveyor system seen in Fig. 2, also a cabinet representing a paint spraying booth

Fig. 2 (left). Part of the Flowmaster automatic tape controlled conveyor system which will be demonstrated on the stand of Fisher & Ludlow, Ltd., Material Handling Division, at the British Trade Fair in Moscow

several different types may be stored on a series of parallel rails which form part of the conveyor, and individual items can be passed, as required, to the main portion of the installation, and then transported to pre-determined positions in various departments in a works, under tape control. The operating speed of the conveyor can be varied electronically by means of push-buttons on the control unit, and the punched tape enables the sequence in which components are handled to be automatically changed after either short or long periods. At the Fair, there will be facilities for visitors to select the sequences in which components are to be handled, and the points in the system to which they are to be directed.

Other products which will be displayed will include Fisholow-Hapman tubular conveyors for granular materials, Flexiroll idler rollers for belt-type conveyors for use in mines and quarries, Flowlink overhead chain conveyors, and Flowline belt-type conveyors for use in assembly departments. Part of the stand will be built up from sections of Flowforge open steel flooring, and examples of tote boxes, pallets, and stillages from the company's extensive range, will be on view. Another exhibit will be a scale model of the Flowfreight multiple decking system for cargo ships. With this system, three decks, built up from Flowforge steel flooring, are provided in the hold, which are spaced to take motor-cars for export during the outward voyage of the vessel. For the return voyage, the decks can be raised by winches and cables so that they are "stacked" close to the under-side of main deck of the ship, and a clear space is then provided in the hold for the accommodation of other cargo.

Soviet Exhibition London

Details of the Soviet Trade and Industry Exhibition, to be held at Earls Court, London, from July 7 to 29, were announced by Mr. M. V. Nesterov, chairman of the U.S.S.R. Chamber of Commerce, in London, on February 14. Mr. Nesterov was introduced by Mr. V. A. Kamensky, leader of the Soviet Trade Delegation in the United Kingdom, who drew attention to the steady increase that has taken place in trade between the U.S.S.R. and this country during the past seven years.

Mr. Nesterov stated that the forthcoming exhibition would be the largest that had been held by the Soviet Union in the U.K., and would occupy an area of 270,000 sq. ft.—the whole of the ground floor and half of the first floor of the Earls Court exhibition building. It was hoped, within the limits of the exhibition, to present a comprehensive picture of the latest Soviet achievements in the fields of science, technology, work, culture, and living conditions, and the nine sections of the exhibition would contain more than 12,000 exhibits. Although particular stress would be laid on progress in atomic energy, space research, electronics and optics, attention would also be drawn to the more practical applications of science. The industrial section would be one of the largest in the exhibition, and would include some of the latest Russian machines and equipment for engineering, light industry, transport, mining, iron and steel production, and the oil and gas industries.

An area of 8,600 sq. ft. would be devoted to machinery and machine tools, which would include examples of the latest equipment for working metal and wood, machines arranged for programme control, and ultrasonic machining equipment.

Apart from its general interest, it was hoped that the exhibition—in conjunction with the British exhibition to be held in Moscow earlier this year—would further stimulate Anglo-Soviet trade, and special arrangements were being made for businessmen to visit the exhibition, and for handling trade enquiries.

Continuous Casting Machine Order

An order for a large installation for the continuous casting of steel has been placed by Shelton Iron & Steel, Ltd., Stoke-on-Trent, with Distington Engineering Co., Ltd., Workington, a subsidiary of The United Steel Companies, Ltd., Sheffield. The plant will be built under licence from Concast A.G., Zurich, and will comprise four vertical continuous casting machines with a total of 13 strands, equipped to cast billets in a large variety of sizes.

Steel for the new installation will be produced in two 45-ton Kaldo converters and will be transferred by ladles to the continuous casting bay. After leaving the spray cooling chambers and the withdrawal rolls, billets less than 7 in. thick will be bent through 90 deg. and discharged on to roller tables. Billets more than 7 in. thick will be cut into suitable lengths during their descent and discharged by baskets to roller paths.

When the new plant is completed, Shelton Iron & Steel, Ltd., it is stated, will have the first integrated steelworks in this country depending entirely on continuous casting for semi-finished steel.

TOTAL STOCKS OF COAL IN GREAT BRITAIN at the end of 1960 amounted to 42,774,000 tons, as compared with 48,985,000 tons at the end of 1959.

U.S. Machine Tool Orders

The U.S. National Machine Tool Builders' Association has reported that net new orders for cutting type machine tools in December totalled 47·6 million dollars. This figure was 12 per cent more than the monthly average for 1960. Deliveries during the month, at 48·6 million dollars, were 15 per cent higher than the monthly average.

For the year 1960, net new orders totalled 503·25 million dollars, which represented a fall of 1 per cent as compared with 1959. The total for deliveries was 507·55 million dollars, or 23 per cent more than in 1959. New export orders amount to 151·3 million dollars, an increase of 127 per cent on the figure for 1958, and for export deliveries the corresponding rise was 138 per cent.

New orders for forming type machine tools in 1960 amounted to 150·15 million dollars, as against 149·95 million dollars in 1959. Deliveries during the year totalled 143·3 million dollars, or 15 per cent more than in 1959. New export orders, at 39·45 million dollars, were 64 per cent higher than in the previous year.

Coming Events

INSTITUTION OF PRODUCTION ENGINEERS.—*London-Brighton Group.* March 1, at 7 p.m., at the Old Ship Hotel, Castle Square, Brighton; lecture on "The Economics of Material Handling," by A. G. Hayek. *Rochester Graduate Section.* March 2, at 7.30 p.m., at the Old Palace, Maidstone, Kent; lecture on "Operational Research," by D. Hicks. *Cornwall Section.* March 1, at 7.15 p.m., at the Cornwall Technical College, Trevenson, Pool, Redruth; lecture on "Recent Developments in the Soviet Union," by Dr. D. F. Galloway. *Western Section.* March 1, at the Grand Hotel, Bristol; lecture on "Machine Tools," by G. W. Wright.

Scrap Metals

MIDLANDS.—There is a general shortage of available scrap in the Midlands due to the lower tonnages arising from the motor car factories and allied works. Demand from consumers varies considerably but merchants are at present able to meet all requirements.

Basic scrap to specifications No. 1 and 2, heavy steel (No. 3), and compressed bales (No. 4) can be delivered to local steelworks, also limited tonnages of 0·04 sulphur and phosphorus scrap.

Steel turnings are becoming more difficult to place. Due to excessive stocks, one local works has placed an embargo on chipped turnings and has put bushy turnings on allocation. Blast furnaces in surrounding areas are accepting material, but some temporary suspensions have been applied to deliveries by rail. Cast iron borings are moving steadily.

The shortage of cast iron scrap persists, and merchants are seeking supplies from all over the country to satisfy the demands of local foundries.

Short heavy steel deliveries are still controlled but most of the material forthcoming is cleared each week. Light pressing scrap of all kinds is wanted at merchants' yards, and particularly new production light steel scrap.

MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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Industrial Notes

EMPLOYMENT IN THE MANUFACTURING INDUSTRIES fell by 56,000 in December to a total of 8,897,000. There was a rise of 2,000 in " shipbuilding and marine engineering," but the numbers employed in " engineering and electrical goods " fell by 6,000, in " vehicles " by 6,000, in " metal goods " by 4,000, and in " metal manufacture " by 1,000.

THE INSTITUTION OF WORKS MANAGERS will hold an international conference at Linden Hall Hotel, Bournemouth, from April 21 to 23. The theme will be " The Role of Management in Industrial Relations." Particulars and registration forms can be obtained from the Conference Secretary, Institution of Works Managers, Nuclear Graphite, Ltd., Poole, Dorset.

DAWE INSTRUMENTS, LTD., Harlequin Avenue, Great West Road, Brentford, Middlesex, as a result of a rapid increase in the sales of ultrasonic cleaning equipment, have formed an Ultrasonic Cleaning Division. Mr. W. R. Tyrrell has been appointed sales manager of this division, and has been succeeded as technical representative in the Bristol area by Mr. J. C. Thomas.

WOLF ELECTRIC TOOLS, LTD., inform us that their Newcastle branch has moved to new and larger premises at 94-96 Heaton Road (telephone, Newcastle-upon-Tyne 659053). Facilities available at this address include a larger service workshop which is well provided with machines and electrical testing equipment, including 3,000-volt apparatus for tests on the company's patented double-insulated tools.

INTRODUCTION TO INDUSTRY COURSE.—A further training course will be held by Westinghouse Brake & Signal Co., Ltd., at their works at Chippenham, Wiltshire, during the Easter vacation, this time for boys who will be taking G.C.E. "A" level examinations in scientific subjects in 1962. This course is intended to give, at first hand, a good insight into the engineering industry. Applications should reach the Personnel Superintendent at the above address by March 1.

CAMBRIDGE INSTRUMENT CO., LTD., report that work is now well advanced on an additional building on the site of their factory in Chesterton Road, Cambridge. This building, which will provide an extra 16,000 sq. ft. of floor space, is of 3-storey construction, and is joined at one end to the recently completed research laboratories. The top floor will house testing, assembly, and wiring departments, and on the first floor there will be production space for the Microscan X-ray analyser, also works offices. This floor is supported on concrete pillars, and the area beneath will provide parking space and a loading bay.

SIMMS MOTOR UNITS, LTD., have recently installed a cold room at their works in Oak Lane, East Finchley, London, N.2, for testing fuel injection, lighting, and starting equipment under Arctic conditions. This room, which measures 13 ft. 5 in. by 10 ft. 9 in., is entered through an air lock compartment. It will accommodate a car of medium size or a 300-b.h.p. engine. Refrigeration equipment supplied by J. & E. Hall, Ltd., Dartford, enables temperatures down to — 40 deg. F. to be obtained. The company is prepared to hire the room to other organizations which may be in need of such facilities at times when it is not required for the testing programme.

PANTAK, LTD., Vale Road, Windsor, Berks., have received an order from Head Wrightson (Teesdale), Ltd. for an 18 MeV Siemens betatron. This mobile particle accelerator, it is claimed, can be used for examining steel thicknesses up to 16 in. Attention is drawn in this connection to the growing trend towards the use of plate of increasing thickness and of denser metals in welded fabrications, particularly for pressure vessels for the nuclear power and refrigeration industries. The unit will operate in the heavy fabrications shop at Thornaby-on-Tees and, it is stated, will require less radiation safeguards than those which must be adopted for other particle accelerators and high power sources.

STANDARD FOR WHITE METAL BEARING ALLOY INGOTS.—Requirements for 9 recommended alloys, which, it is considered, cover the range of properties generally needed in white metal bearing alloys, are laid down in B.S.3332: 1961. It is pointed out that whereas elements such as cadmium, nickel, silver, tellurium, and arsenic, are sometimes added to such alloys, these variants have not been included in the standard, because some of the resulting alloys, for which improved properties are claimed for particular applications, are more difficult to use.

Copies of the new standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1 (price 5s., postage extra to non-subscribers).

CASTROL, LTD., Castrol House, Marylebone Road, London, N.W.1, have formed an Engineering Division to " bring together and intensify the expanding engineering operations of the Group," which cover design, manufacture, installation, and servicing of a wide range of lubricating plant and equipment for both automotive and industrial applications. Mr. Richard Adams, M.I.Mech.E., M.I.Chem.E., M.B.I.M., A.M.I.Civil E., A.F.Inst.Pet., has been appointed general manager of the new Division, which embraces the following departments: Lubrequipment (automotive lubricating equipment); Mechanical Appliances (industrial lubricating equipment); Service; and Drawing Office.

EXPERT INDUSTRIAL CONTROLS, LTD., is the title of a new company which has been formed to amalgamate the businesses of Sharp Control Gear, Ltd., and Electram Coil Co., Ltd., two member companies of the Expert Tool Group. The address is Lount Works, Ashby-de-la-Zouch, Leicestershire. It is pointed out that for the past three years the companies have had the same management, and that there has been considerable overlap in the sales and production organizations. The complete amalgamation will permit more intensive development, production, and home and export marketing, in the fields of traction and industrial control gear, industrial solenoids, and other forms of automation equipment.

Standardization of Tooling Areas on Machines

(*Continued from page* 407)

In commenting on the report of the committee, the Machine Tool Trades Association expressed full agreement with the proposals that more attention "should be given to standardization of machine tools, and of modular units for special-purpose and transfer machines." They pointed out, however, that work was already being done on machine tool and unit standardization, although it was not proceeding as rapidly as they would have wished. Progress, it appears, is being hampered by the difficulties associated with international co-ordination, which is obviously of great importance in this connection. National standards covering tooling area features of machines would certainly represent a considerable advance, but in view of the large and growing scale of machine tool interchange between countries, a wide measure of international agreement would be necessary before the full benefits could be reaped.

Lubrication Engineering Symposium

The Institution of Plant Engineers have organized a symposium on lubrication engineering, which will be held, on March 23, in the meeting hall of the Institution of Mechanical Engineers, 1 Birdcage Walk, Westminster, London, S.W.1. There will be four papers concerned with: Lubrication Engineering and the Petroleum Industry; the Chemical Industry; the Steel Industry; and the Plant Manufacturer.

The meeting will be open to non-members of the Institution and copies of the papers will be available in advance. Registration forms can be obtained from the Secretary, The Institution of Plant Engineers, 2 Grosvenor Gardens, London, S.W.1.

New Appointments

The following appointments have been announced:—

MR. HUGH MILLER as director of Benson Bond, Ltd., P.O. Box 272, Station Road, Birmingham, 23. Mr. Miller was previously general sales manager of the company.

MR. B. L. BARDELL and MR. N. H. OLLEY as joint technical directors of M.T.E. Control Gear, Ltd., Leigh-on-Sea, Essex. Mr. Bardell was previously chief electrical engineer, and Mr. Olley, chief design engineer responsible for the design and development of the M.T.E. Progress range of control gear components.

MR. J. R. SINCLAIR, A.M.I.Mech.E., as a senior sales engineer to represent Stein Atkinson Vickers Hydraulics, Ltd., 197 Knightsbridge, London, S.W.1, in the South Wales and Gloucestershire areas. He was previously with Richard Thomas & Baldwins, Ltd., and joined the company on January 1.

MR. C. HOLMES-WALKER as manager of the Eastern Division of the Power Petroleum Co., Ltd., 86-96 Strand, London, W.C.2, in succession to Mr. H. R. C. Rides, who retired in January. Mr. Holmes-Walker was formerly branch manager at Chester and divisional manager, Merseyside.

MR. F. O. HORSTMANN, formerly managing director of the Horstmann Gear Co., Ltd., Newbridge Works, Bath, as chairman of the company, and Mr. D. W. Nicholds, recently works manager, as works director. Mr. C. W. Mant, chairman since 1946, becomes vice-chairman, Mr. F. A. Wheeler remains secretary with a seat on the board.

Churchill Machine Tool Board

Following the acceptance of the offer by the Birmingham Small Arms Co., Ltd., to acquire the share capital of Churchill Machine Tool Co., Ltd., there has been a number of changes in the Churchill board. Two directors of the B.S.A. parent board, Mr. Eric Turner (deputy chairman and chief executive) and Mr. S. A. Roberts (managing director of B.S.A. Tools, Ltd.) have been appointed directors of Churchill, and Mr. Turner becomes chairman. Mr. E. W. Hunnisette remains on the board as managing director. Sir Greville S. Maginness, Mr. Paul Chamberlain, and Mr. Harold E. Churchill have retired from the Churchill board.

Obituary

SIR ARTHUR CROFT. We regret to announce the death of Sir Arthur Croft, chairman of Crofts Engineers (Holdings), Ltd., Bradford, at the age of 74. He joined the business of Arthur Croft & Co. as an apprentice in 1903, 16 years after it had been founded by his father, and was appointed a director when it became a private limited company in 1907. Following his father's death in 1920, he became joint chairman and was appointed governing director in 1936. When the public company was incorporated in 1948, he became chairman and managing director. Under his direction the company played an important part during the second world war in equipping munitions factories with power transmission equipment. Sir Arthur received his knighthood in 1953.

Automatic Loading on a Red Ring Gear Shaver

(*Continued from page* 453)

space at the upper end. With repeated operation, and no renewal of the supply, the number of empty spaces on the conveyor increases until it is empty, when the machine stops automatically. It will be appreciated, however, that whatever the number of parts on the conveyor at any time, they all occupy adjacent spaces. A similar sequence of movements is performed by the unloading conveyor, which continues to operate after the machine has stopped, until it is empty.

Machine Tool Share Market

Very active conditions prevailed in most sections of the stock markets during the period under review, and although there was some uncertainty towards the finish, the general undertone remained firm.

British Funds and similar gilt-edged stocks attracted moderate investment support. After they had been mainly steady, there was some reaction, but the tone hardened again at the close.

Commercial and industrial share markets were active and the trend was upwards for the most part. They became irregular, however, and ended quietly, with final prices below the best. Nevertheless, gains on balance were numerous and well spread.

Among machine tool issues, Edgar Allen advanced 1s. to 39s.; Asquith Machine Tool, 1s. to 12s. 6d.; British Oxygen, 1s. to 28s. 6d.; Broom & Wade, 1s. to 24s. 9d.; Chas. Churchill, 9d. to 9s. 1½d.; Geo. Cohen, 1s. to 13s. 6d.; John Harper, 1½d. to 8s. 1½d.; A. A. Jones & Shipman, 1s. 3d. to 32s. 6d.; Macready's Metal, 1s. to 16s.; John Shaw & Sons (Wolverhampton) 1½d. to 16s. 10½d.; Tap & Die Corporation, 6d. to 15s. 3d.; and Thos. W. Ward, 5s. 6d. to 70s. On the other hand, Craven Bros. (Manchester) lost 9d. to 10s.; Greenwood & Batley, 1s. at 24s. 9d.; and Kerry's (Gt. Britain), 3d. at 9s. 9d.

Trade Publications

INCANITE FOUNDRIES, Division of The Incandescent Heat Co., Ltd., Cornwall Road, Smethwick, Birmingham, 40. Leaflet drawing attention to the properties of Incanite high duty cast iron, which is intended for press tools and similar applications.

METALLIZATION, LTD., Barclays Bank Chambers, Dudley, Worcs. Brochure entitled "Heat Resistant Coatings by the Metal Spraying Process." Sections are devoted to aluminium coatings, aluminizing, and nickel-chromium coatings. Reference is also made to a modified aluminizing process for the treatment of steel which is to be exposed to molten metals.

ACCESS EQUIPMENT, LTD., Maylands Avenue, Hemel Hempstead, Herts. Leaflets and brochures concerned with the following products: the Tallescope aluminium telescopic work platform; Access "freight loader" mechanism; Giraffe hydraulic working platforms; Bicep hydraulic lifters; the Wall Spider suspended platform; the Beanstalk mobile hydraulic working platform; Mountie safety steps which are available in 40 different types; Zip-Up staging of various types; Safety Raiser mobile adjustable working platforms; and "Go-Safe" scaffold boards.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/3xd
Allen (Edgar) & Co., Ltd.	Ord.	£1	39/-
" " "	5% Prf.	£1	14/-*
Arnott & Harrison, Ltd.	Ord.	4/-	13/3
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	12/6xd
" " "	6% Cum. Prf.	£1	16/3
Birmingham Small Arms Co., Ltd.	Ord.	10/-	31/- ex capt.
" " "	5% Cum. "A" Prf.	£1	14/6
" " "	6% Cum. "B" Prf.	£1	16/6
" " "	4% 1st Mort. Deb.	Stk.	90½
British Oxygen Co., Ltd.	Ord.	5/-	28/6
" " "	6% Cum. Prf.	£1	20/-
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	6/10½
Broom & Wade, Ltd.	Ord.	5/-	24/9
" " "	6% Cum. Prf.	£1	17/-
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	16/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/-
Butler Machine Tool Co., Ltd.	Ord.	5/-	17/6
" " "	5% Cum. Prf.	£1	14/3
Churchill (Charles) & Co., Ltd.	Ord.	2/-	9/1½
" " "	6% Cum. Prf.	£1	25/9‡
Churchill Machine Tool Co., Ltd.	Ord.	5/-	39/6
" " "	6% Cum. Prf.	£1	17/6
Clarkson (Engrs.), Ltd.	Ord.	5/-	27/6
Cohen (George), 600 Group, Ltd.	Ord.	5/-	13/6
" " "	4½% Cum. Prf.	£1	13/-
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	26/3 ex rights
" " "	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	10/-
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/1½xd
" "	4½% Red. Cum. Prf.	£1	13/-
Expert Tool & Case Hardening Co., Ltd.	Ord.	2/-	2/-
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	11/-
Greenwood & Batley, Ltd.	Ord.	10/-	24/9
Harper (John) & Co., Ltd.	Ord.	5/-	8/1½
" "	4½% Red. Cum. Prf.	£1	12/3

COMPANY		Denom.	Middle Price
Herbert (Alfred), Ltd.	Ord.	£1	60/-
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	16/3
" " "	"B" Ord.	5/-	15/-
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	32/6
" " "	7% Cum. Prf.	5/-	5/-
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	11/-
" " "	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/-	18/9
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	9/9
Macreadys Metal Co., Ltd.	Ord.	5/-	16/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/-
Massey (B. & S.), Ltd.	Ord.	5/-	10/-
Newall Engineering Co., Ltd.	Ord.	2/-	7/6
Newman Industries, Ltd.	Ord.	2/-	5/3
" "	6% Prf. Ord.	5/-	5/-
Noble & Lund, Ltd.	Ord.	2/-	5/6
Norton, W. E. (Holdings), Ltd.	Ord.	2/-	3/9
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	43/6
" " "	5½% Cum. Prf.	£1	25/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	15/-
Sanderson Kayser, Ltd.	Ord.	10/-	34/4½
" " "	6½% Cum. Prf.	£1	18/-
Scottish Machine Tool Corporation Ltd.	Ord.	4/-	10/-
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	45/-
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	16/10½
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	16/-
" " "	5% Cum. Prf.	£1	14/3
Stedall & Co., Ltd.	Ord.	5/-	8/9
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	24/-
Tap & Die Corporation, Ltd.	Ord.	5/-	15/3
" " "	4½% Deb. 1961-1977	Stk.	84½
Wadkin, Ltd.	Ord.	10/-	20/-
Ward (Thos. W.), Ltd.	Ord.	£1	70/-
" "	5% Cum. 1st Pref.	£1	14/-
" "	5% Cum. 2nd Pref.	£1	22/-
Wilson Lathes, Ltd.	Ord.	1/-	3/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. ‡ Birmingham price.

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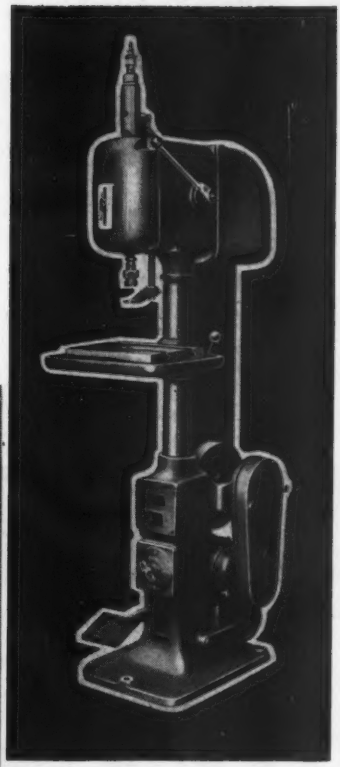
LEAD SCREW ATTACHMENT. This auxiliary attachment is supplied as standard with the machine.



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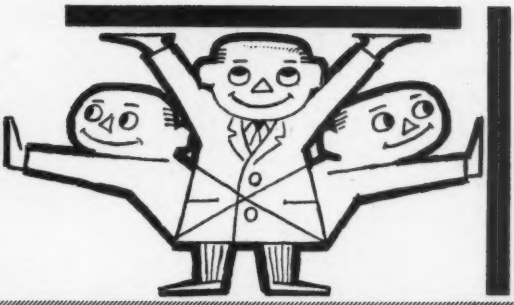
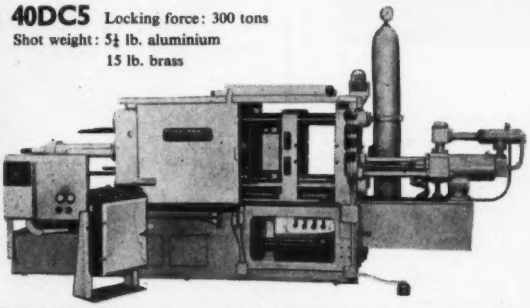
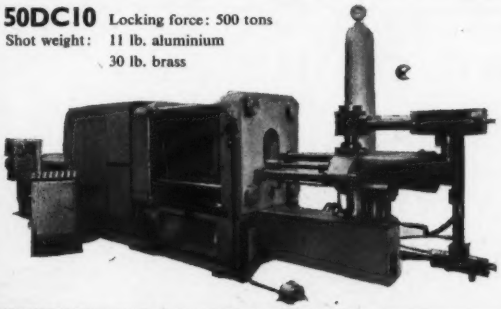


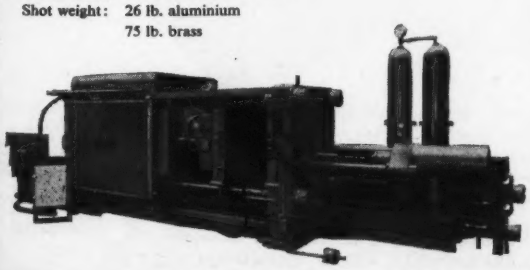
40DC5 Locking force: 300 tons
Shot weight: 5½ lb. aluminium
15 lb. brass



50DC10 Locking force: 500 tons
Shot weight: 11 lb. aluminium
30 lb. brass



60DC20 Locking force: 750 tons
Shot weight: 26 lb. aluminium
75 lb. brass



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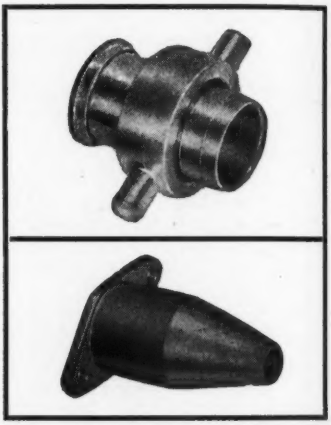

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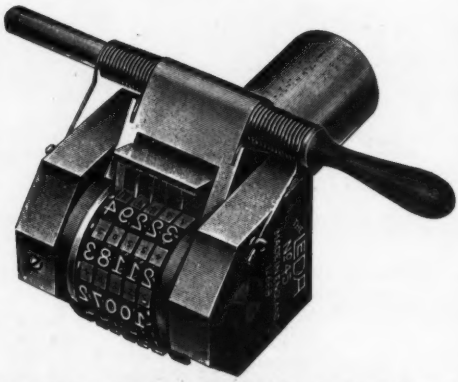

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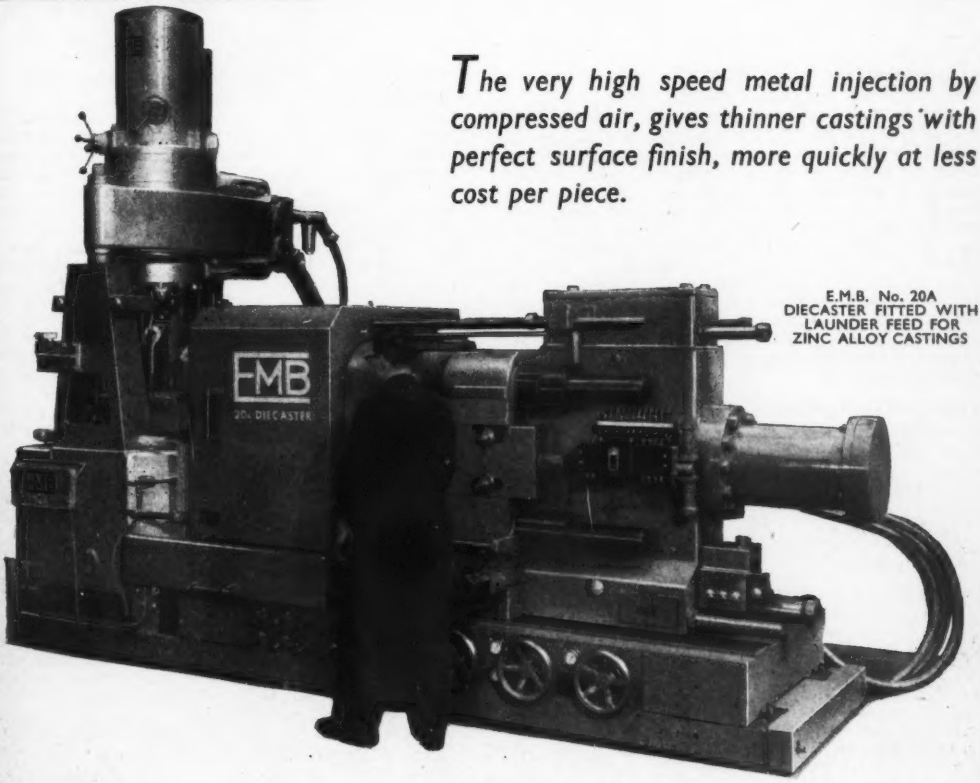

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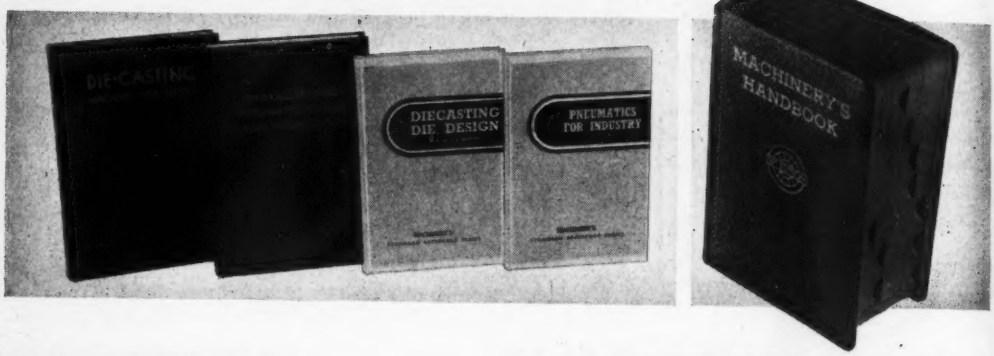

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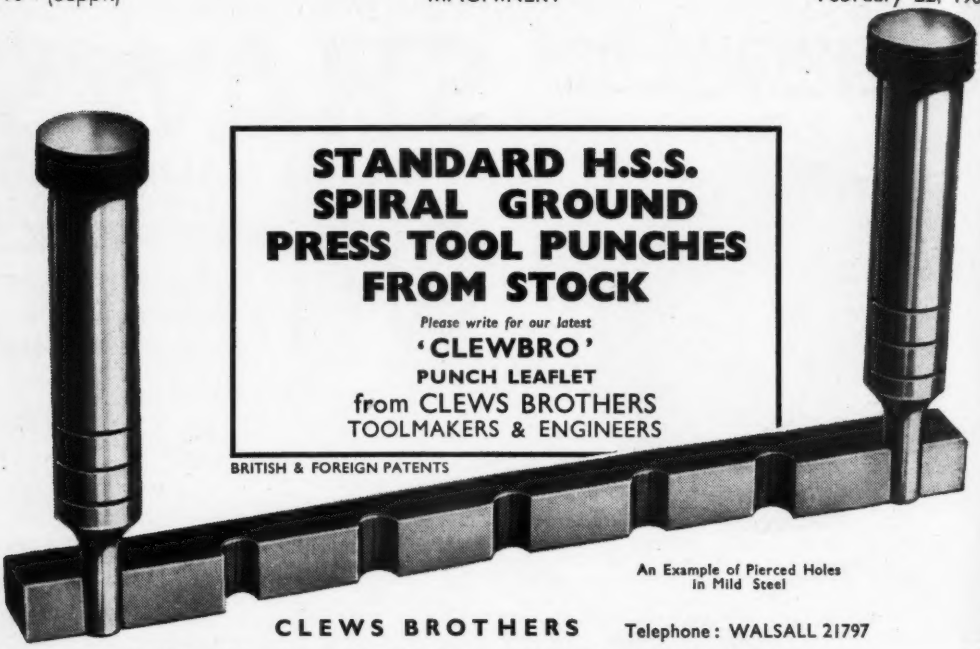

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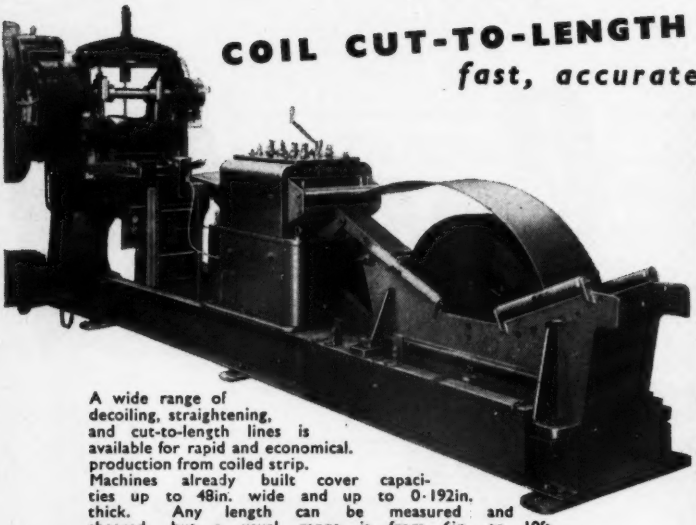

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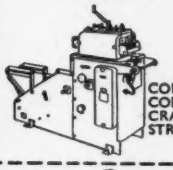

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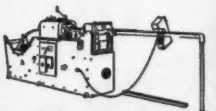

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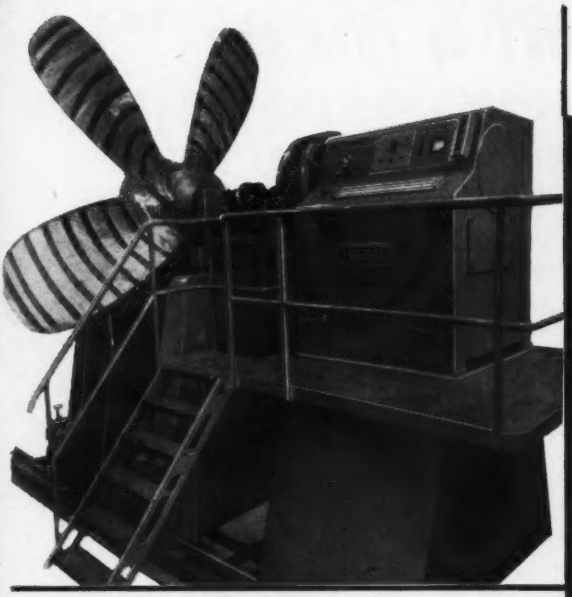

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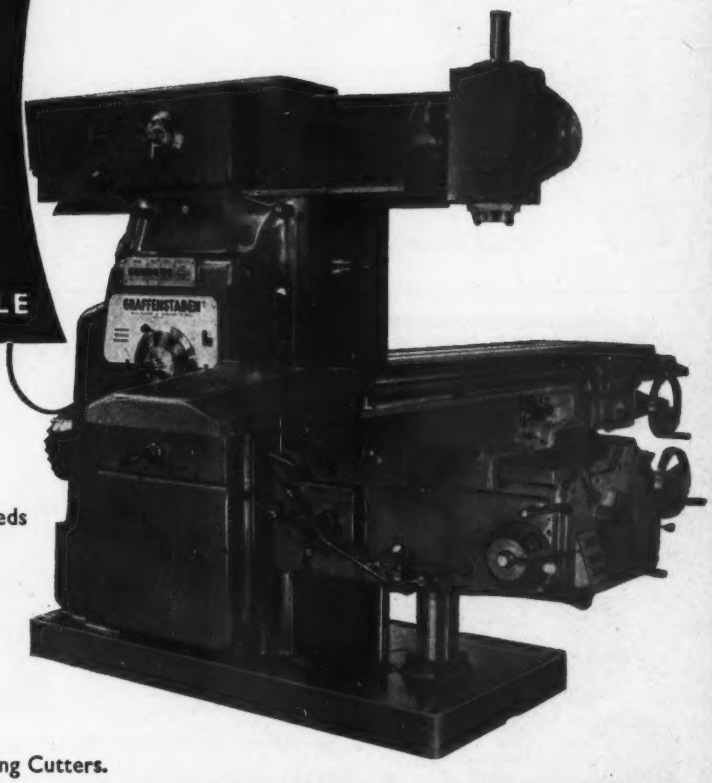

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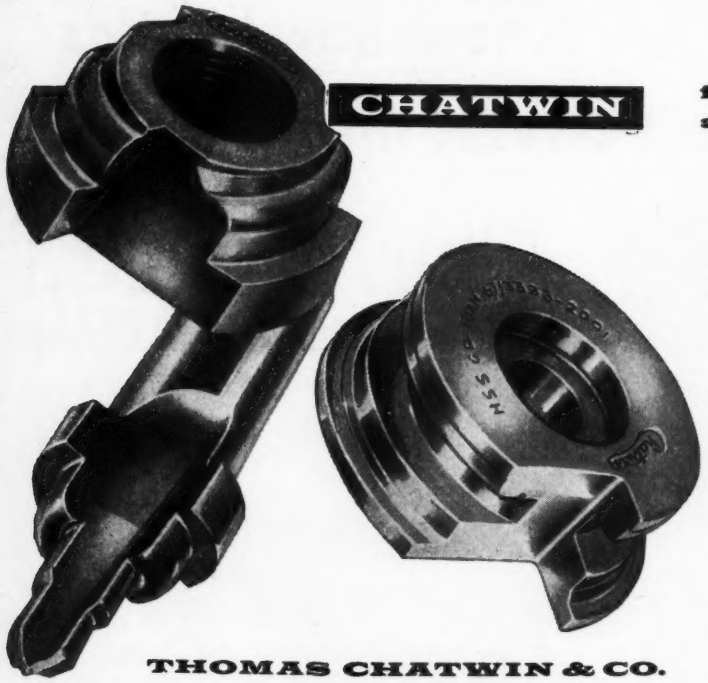

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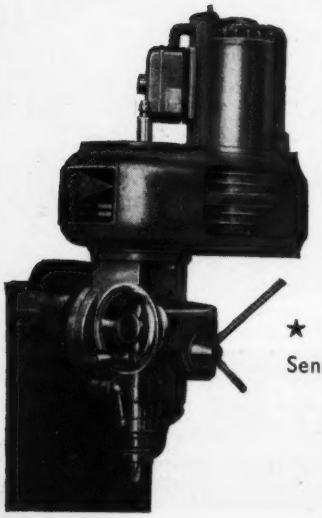

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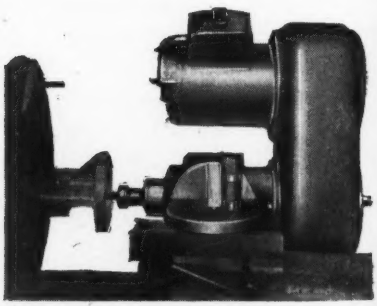

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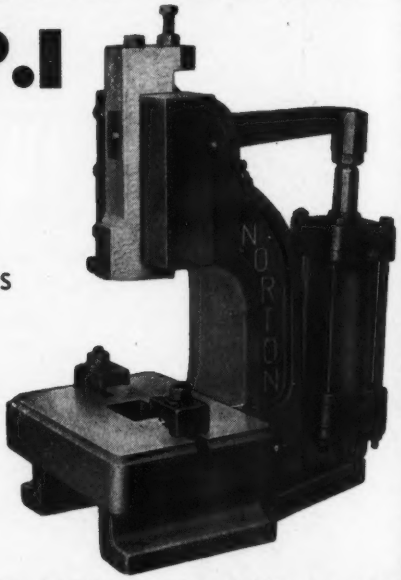

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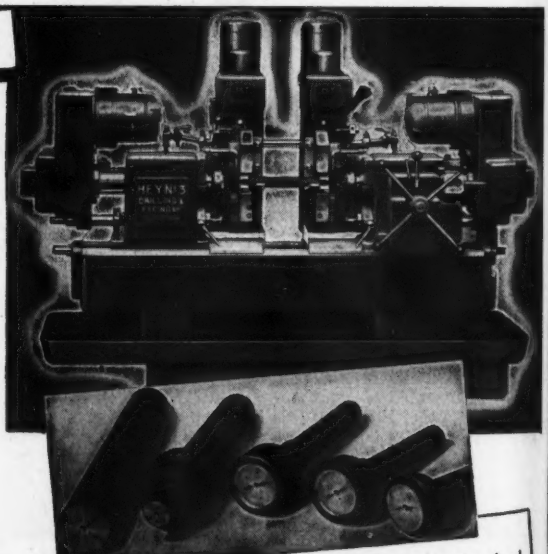

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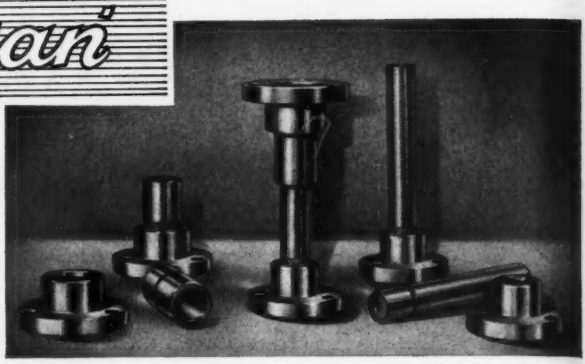

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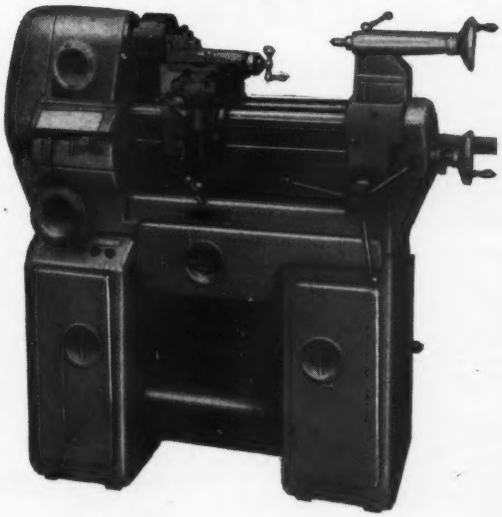

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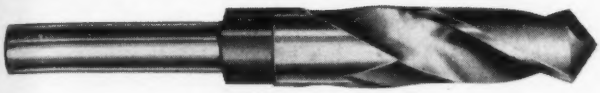

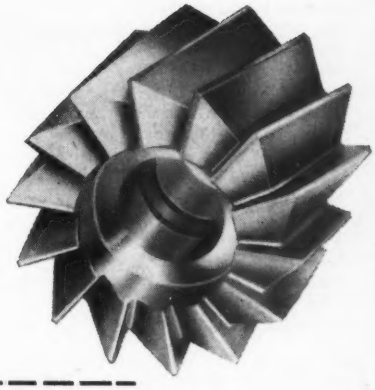

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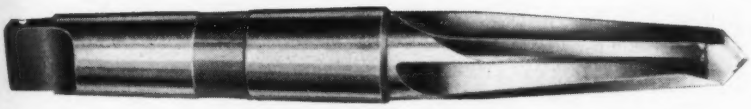
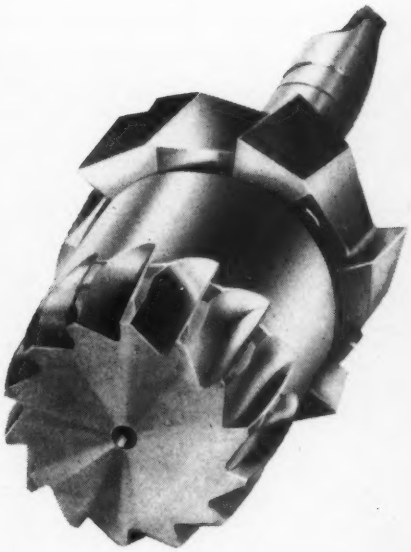


and "specials" that are extra special



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vertical borers for immediate delivery

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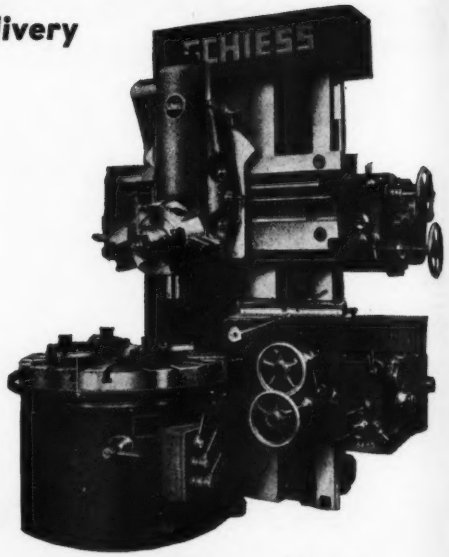
Max. turning dia. with side head in lowest position	49 in.
Diameter of table	39 in.
Maximum turning height above table	43 in.
Maximum vertical tool travel of cross rail slide	28 in.
Maximum distance between table and turret	52 in.
Diameter of turret holes	3½ in.
Size of tools	1¼ x 1⅝ in.
Maximum horizontal movement of side head	22 in.
Max. distance between table & underside of side head turret	32 in.
Vertical movement of cross rail	30 in.
Maximum weight of work	3 tons
Table speeds	(12), 9 to 155 r.p.m.
Horizontal and vertical feeds	(8), 0.0059 to 0.224 in.
Power required	40 h.p.
Net weight	27,300 lb.



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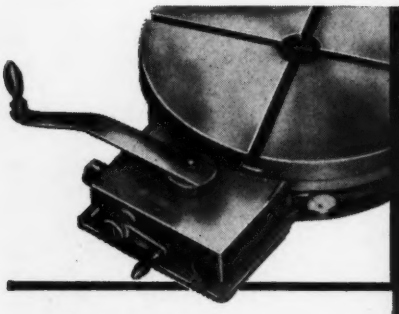
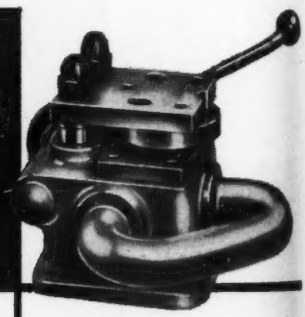
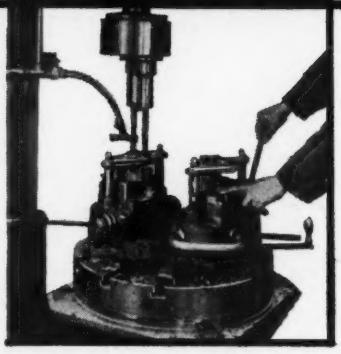


PEISELER Circular Indexing Tables and Quick Clamping Drill Jigs





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The illustration on the right shows two Peiseler quick clamping drill jigs used in conjunction with a Peiseler Circular Indexing Table.

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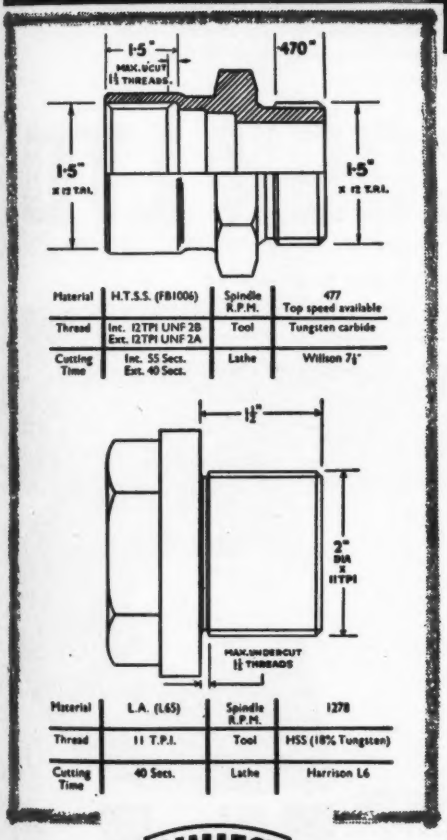

Material	H.T.S.S. (FB1006)	Spindle R.P.M.	477 Top speed available
Thread	Int. 12TPI UNF 2B Ext. 12TPI UNF 2A	Tool	Tungsten carbide
Cutting Time	Int. 55 Secs. Ext. 40 Secs.	Lathe	Willson 7½"

Material	L.A. (L65)	Spindle R.P.M.	1278
Thread	11 T.P.I.	Tool	HSS (18% Tungsten)
Cutting Time	40 Secs.	Lathe	Harrison L6

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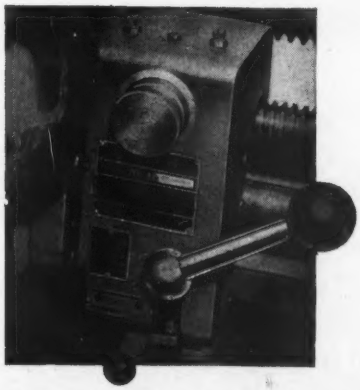

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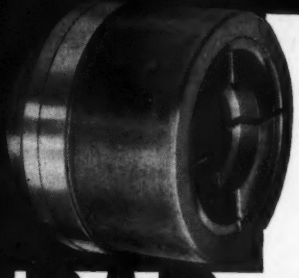

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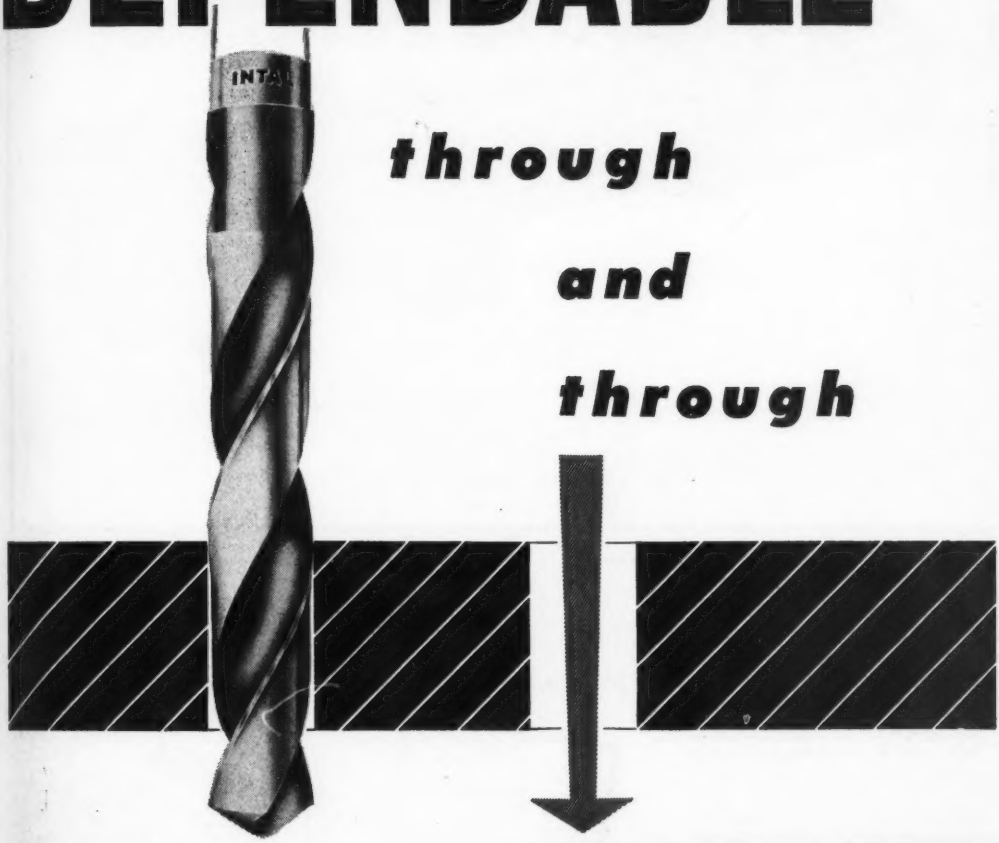

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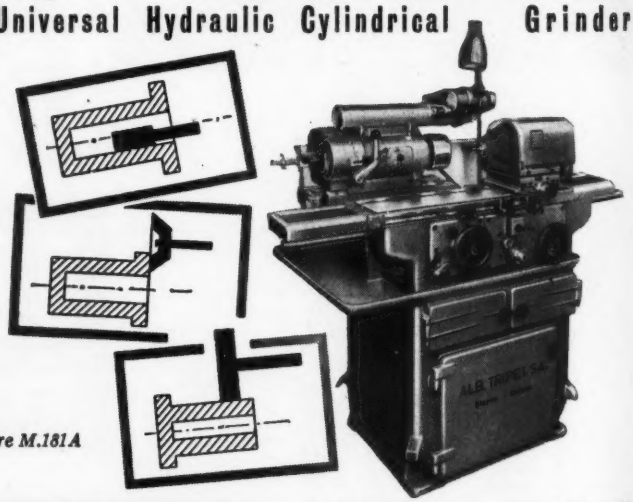

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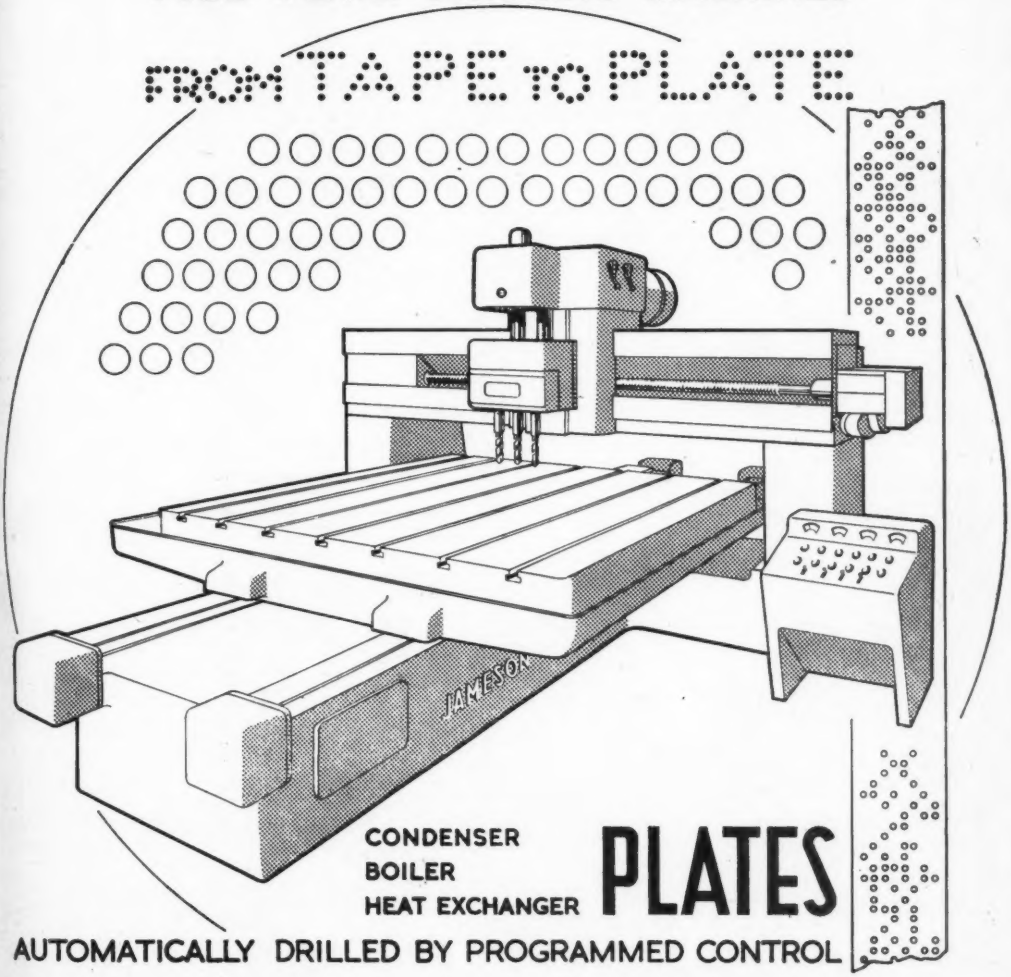

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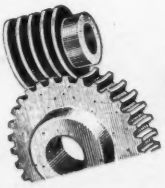

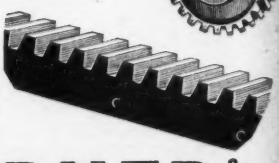

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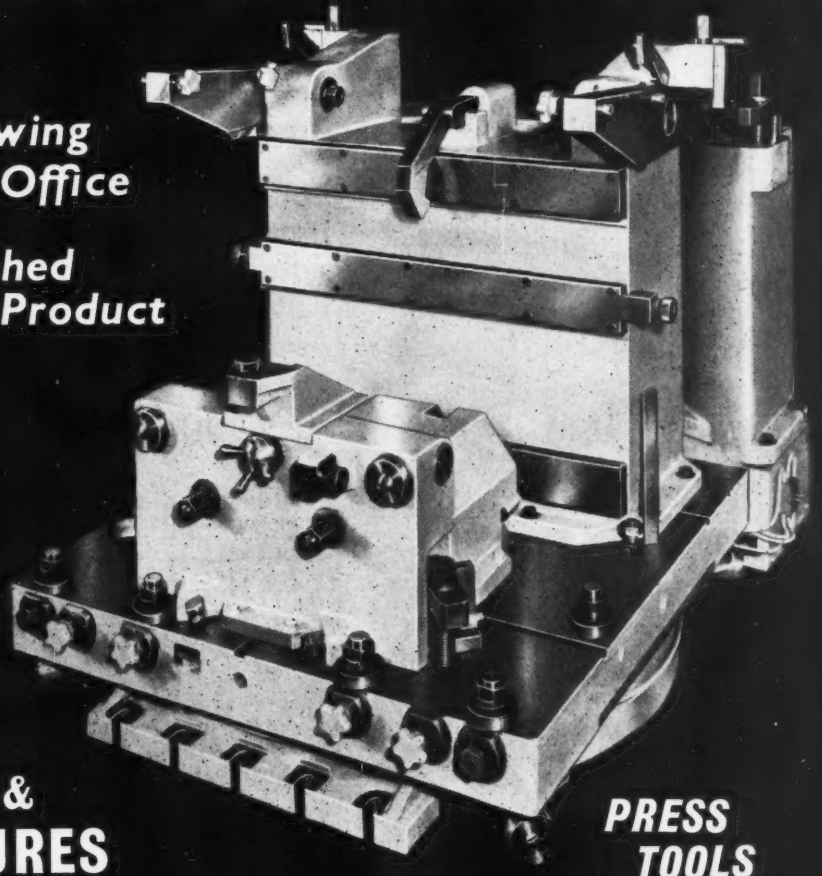

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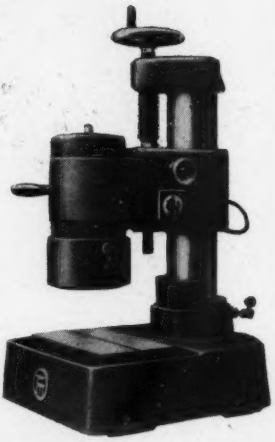

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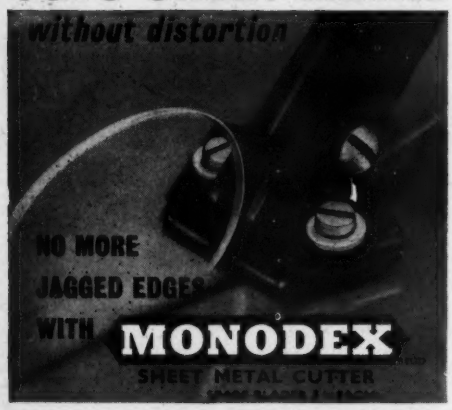

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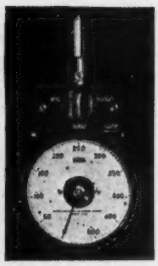

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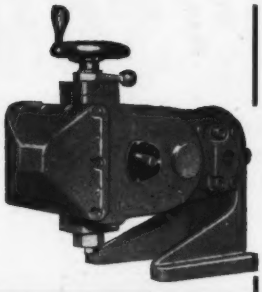

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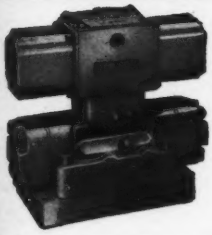

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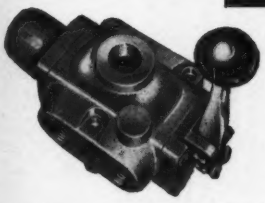

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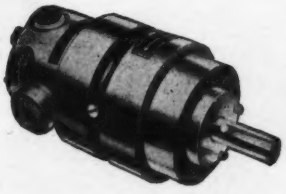

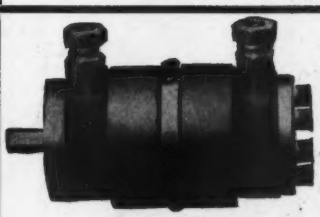

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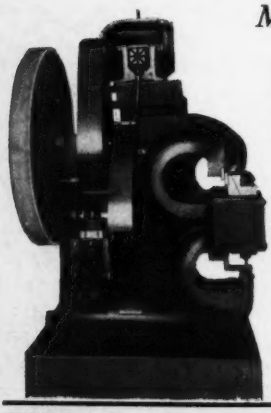

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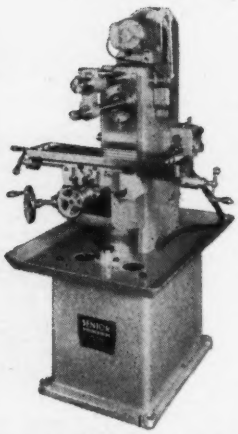

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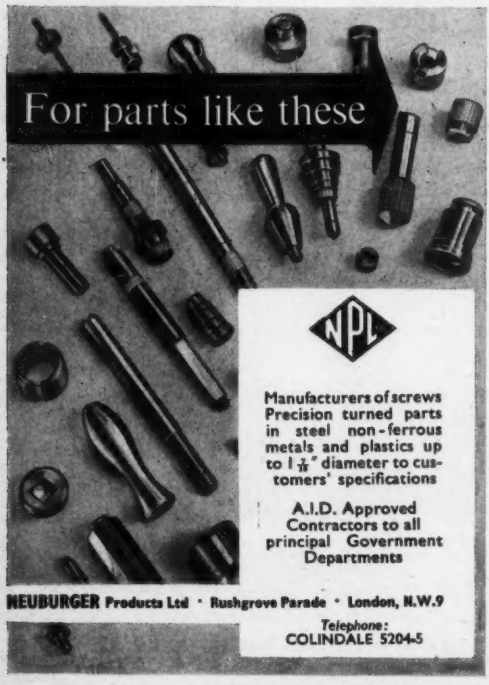

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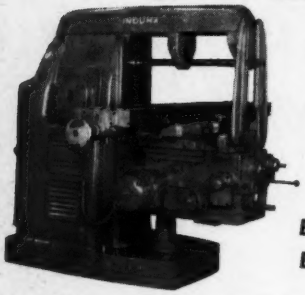

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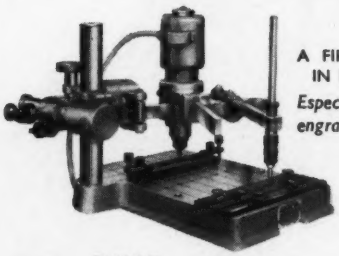

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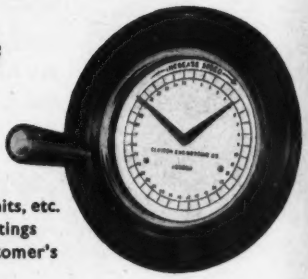

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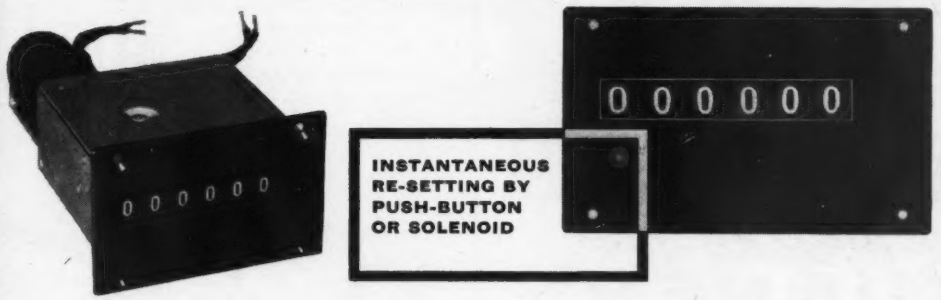

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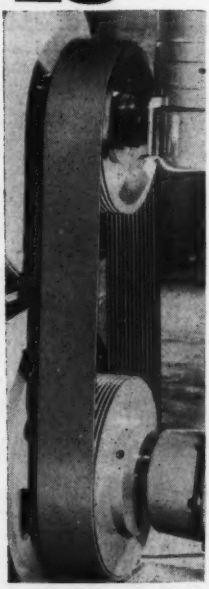

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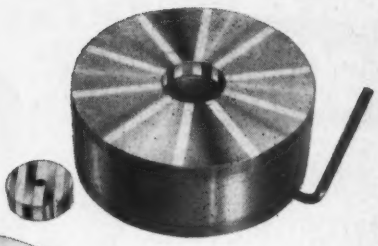

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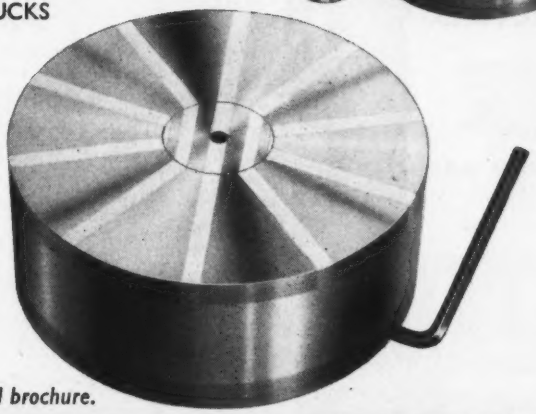

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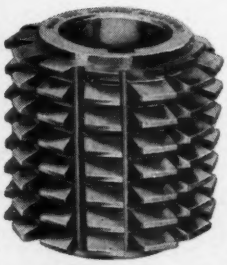

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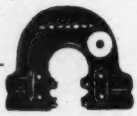

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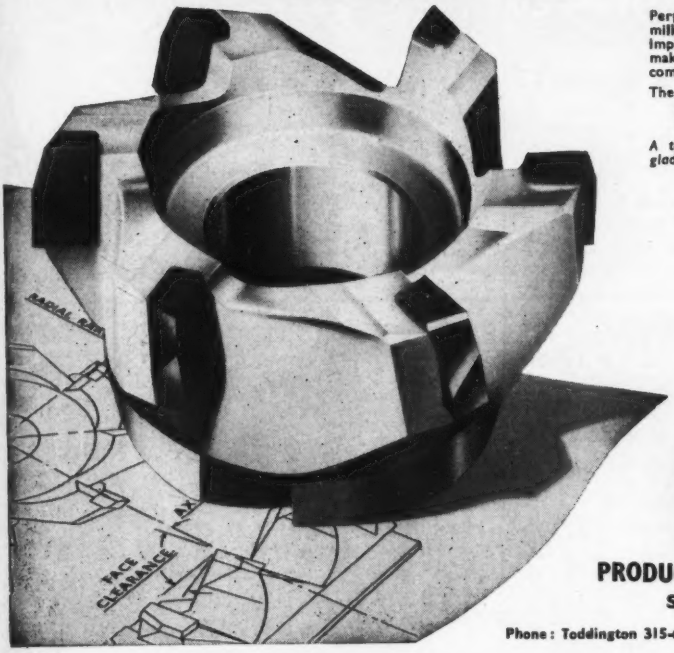

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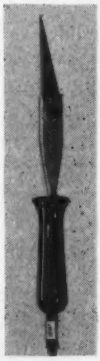

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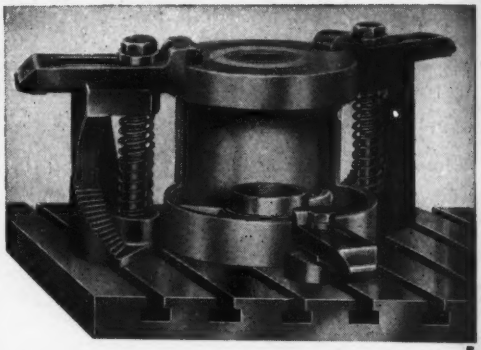

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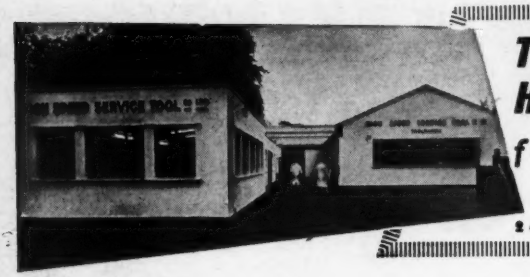

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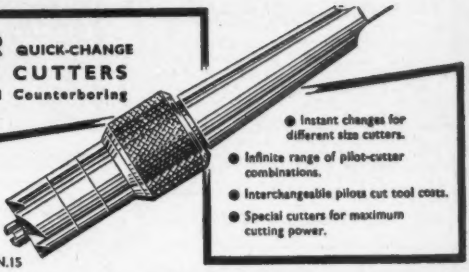

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PROGRESS No. 1 ½in. capacity Bench.
PROGRESS Model 2GS ⅝in. capacity Pillar.
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Covered Bed, 25in. Concentric Chuck, 27in. 4-Jaw Independent Chuck, Good Turret, Tooling Taper Turning Attachment, 35-h.p. Motor, 400/3/50.
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Selections of Machine Tools from Stock or Early Delivery

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ARCHDALE Column Type Vertical Drilling Machine, compound table 27in. × 16in., No. 4 M.T. spindle. Motorised 400/3/50 supply.

CORONA 48in. High Speed Radial Drilling Machine, 8 speeds 84-1,465 r.p.m., No. 3 M.T. spindle. Motorised 400/3/50 supply.

ASQUITH Model O.D.1 6ft. Heavy Duty Radial Drilling and Tapping Machine. Motorised 400/3/50 cycles, with loose box drilling table.

ASQUITH 5ft. 9in. Portable Universal Radial Drilling Machine, motorised 400/3/50 cycles.

BORING MACHINES

GRAHAM & NORMANTON Surfacing and Boring Lathe, swing 42in. dia. in gap, 18 spindle speeds 9/461 r.p.m., motorised 400/3/50 supply.

GRAHAM & NORMANTON Surfacing and Boring Lathe, with Norton type screwcutting gearbox, 42in. swing in gap, 18 spindle speeds 9/461. Motorised 400/3/50 cycles.

WEBSTER & BENNETT 36in. Vertical Boring Mill, with side head, motorised 400/3/50 cycles.

WEBSTER & BENNETT 48in. Single Column Type Vert. Boring Mill, mot. 400/3/50 cycles.

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BUTLER 8in. stroke Production type Slotting Machine, 20in. dia. rotary table. Motorised 400/3/50 cycles.

PLANING MACHINE

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LANG 18in. Centre Lathe, one saddle, admit 10ft. 6in. between centres, mot. 400/3/50 cy.

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CINCINNATI Model 34/60 Duplex Hydromatic Milling Machine, size of table 79in. × 18in., longitudinal feed 60in., motorised 400/3/50 supply.

CINCINNATI Model 4/48 Plain Hydraulic Milling Machine, size of table 65in. × 16in., longitudinal table feed 48in., motorised 400/3/50 supply.

HERBERT No. 46V Vertical Milling Machine, with sliding head, working surface of table 58in. × 15in., longitudinal traverse of table 36in., 12 spindle speeds 25/500 r.p.m., motorised 400/3/50 supply.

CINCINNATI No. 3 Semi-Dial Type Vertical Milling Machine, working surface of table 50in. × 18in., spindle speeds 18/450. Motorised 400/3/50 cycles.

C.V.A. "Kearney & Trecker" model 2E Dial Type Horizontal Plain Milling Machine, working surface of table 41in. × 12in., longitudinal feed 29in., cross feed 12in., 8 spindle speeds 25/1,000 r.p.m., motorised 400/3/50 supply.

CINCINNATI Model 3/36 Hydromatic Milling Machine, table 54in. × 14in., motorised 400/3/50 cycles.

MANN Vertical Milling Machine, with swivel head, dial change to spindle speeds and feeds, table 46in. × 12in., 9 speeds 48/750 r.p.m., motorised 400/3/50 supply.

BROACHING MACHINE

CINCINNATI 10 ton Vert. Single Ram Hydraulic Surface Broaching Machine, 66in. stroke, 20in. × 20in. table, mot. 400/3/50 cycles.

GRINDING MACHINES

PRECIMAX Model MPL 6in. × 24in. Hydraulic Plain Cylindrical Grinding Machine. Hydraulic feed to table, motorised 400/3/50 supply.

JONES & SHIPMAN Fig. 540 Horizontal Spindle Hydraulic Surface Grinder, table 18in. × 6in., motorised 400/3/50 cycles.

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NEW **BUTTERLEY** 5D Power Press, 40 tons capacity, adjustable stroke 4¼in.

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MP.60714—**BLISS** No. 5-S (U.S.A.) Double Side Single Crank Double Geared Toggle Drawing Press. Capacity approximately 200 tons, punch stroke 20in., blank holder stroke 10in., bed 34in. by 35in., counterweight ram balance, friction clutch and brake, motor drive 400/3/50, with guards. **£3,000.**

MP.60718—**BLISS** No. 306A (Derby) Straight Side Single Action Single Crank Press, capacity 150 tons, stroke 6½in., bed 24in. by 25in., tie rod frame, key clutch, motor drive 400/3/50, with guards. **£1,600.**

MP.60720—**TAYLOR & CHALLEN** 1569/No. 752 Double Side Single Geared Press, capacity 100 tons, adjustable stroke 1in. to 5in., table 30in. by 24in., motor drive 400/3/50, with guards. **£1,850.**

MP.60717—**TAYLOR & CHALLEN** No. 562/62 Double Side Single Geared Press, capacity 100 tons, stroke 4in., table 20in. by 24in., plate clutch, motor drive 400/3/50, with guards. **£900.**

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MP.60673—**LECRA** 60.ND Open Back Geared Inclinable Press, capacity 60 tons, stroke 4in., bed 30in. by 19½in., motor drive 400/3/50, with tie rods. **£925.**

MP.60712—**RHODES** Double Side Single Geared Toggle Action Drawing Press, capacity approximately 50 tons, punch stroke 6½in., blank holder stroke 3½in., table 14in. by 21in. motor drive 400/3/50, with guards. **£600.**

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MP.60694—**LECRA** 40.ND Open Front Adjustable Table Horn Press, capacity 25 tons, stroke 3in., bed 24in. by 21in. motor drive 400/3/50. **£450.**

MP.60659—**LECRA** 20½.ND Open Back Inclinable Press, capacity 25 tons, stroke 3in., bed 24½in. by 16in., motor drive 400/3/50. **£450.**

MP.60672—**LECRA** 38.ND Open Front Adjustable Table, Horn Press, capacity 20 tons, stroke 2½in., bed 20in. by 16in., motor drive 400/3/50. **£325.**

MP.60708—**TAYLOR & CHALLEN** 370/No. 350 Open Back Geared Rigid Press, capacity 20 tons, 4in. stroke, motor drive 400/3/50, with tie rods and guards. **£300.**

MP.60653—**LECRA** 19.ND Open Back Inclinable Press, capacity 15 tons, stroke 2in., bed 18in. by 10in., motor drive 400/3/50. **£300.**

MP.60663—**LECRA** 16.ND Open Front Adjustable Table Horn Press, capacity 15 tons, stroke 2in., bed 15½in. by 11½in. motor drive 400/3/50. **£275.**

MP.60666—**LECRA** 8.ND Bench Press, capacity 3 tons, stroke 1in., bed 11in. by 6½in., motor drive 400/3/50. **£95.**

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MIDLAND

AUTOMATICS

BULLARD "Mult-au-Matic" 8 spindle—11in. swing.

BORING MACHINES

KEARNS No. 2 Patent Horizontal Borer. 3in. Trav. spindle. 29in. Facing head.

WEBSTER & BENNETT 24in. swing "Duplex" Vertical Borer.

WEBSTER & BENNETT 36in. swing "Duplex" Vertical Borer.

BANDSAW

THIEL No. 17 Metal Bandsaw.

CROPPING MACHINES

Angle Cropping Machine. Cap up to 6in. × ½in. angles.

DRILLING MACHINE

POLLARD 13in. Pillar Drill. No. 2 Morse Taper. R. & F. Table 11in. × 11in.

GRINDING MACHINES

ELB 24in. × 8in. Hydraulic Surface Grinder. Non-electric mag. chuck.

ORCUTT Gear Grinding Machine.

SAMSON 24in. × 8in. Horizontal Surface Grinder.

New **NORTON** 10in., 12in., 14in., 16in. and 20in. D/E. Tool Grinders.

CAPSTAN AND CENTRE LATHES

HERBERT 9 Combination Turret Lathe.

WARD 10/13 Combination Turret Lathe. Covered Bed. 4½in. H/SP.

HENDEY 9in. S.S. & S.C. Lathe. 12 speeds 14 to 478 r.p.m. Taper turning 4ft. 6in. between centres.

LANG 10½in. × 5ft. S.S. & S.C. Gap Bed Lathe.

LANG 22in. Surfacing and Boring Lathe, Hex. Turret.

CHURCHILL-REDMAN 18in. C.H. × 7ft. 0in B.C. Gap Bed S.S. & S.C. Lathe.

HAMMERS

MASSEY 5 cwt. Slide Type Pneumatic Hammer. 400/3/50.

PRESSES

BRADLEY & TURTON No. 3 Flypress.

SWEENEY & BLOCKSIDGE Bench Press. Cap. 3 tons.

SCREWING MACHINE

KENDALL & GENT 3½in. Screwing Machine. Leadscrew Type.

SHAPING MACHINE

WOTAN 27in. stroke Hydraulic Shaper.

POLISHING MACHINE

3 and 5 h.p. Polishing Spindles.

All machines 400/3/50 electrics unless otherwise stated.

THE
MIDLAND MACHINE TOOL CO.
BRADLEY, BILSTON, STAFFS.
Tel.: Bilston 42471/9.

Archdale Multi-spindle Drilling Machine. Size O. Table 20in. × 20in. 10 spindles No. 1 Morse taper. Motorised 400/3/50.—BOX C550, MACHINERY, Clifton House, Euston Road, N.W.1.

6-spindle 1½in. Dia. Bar Capacity Greenlea Automatic Machine. Excellent condition, well equipped with Tools and Attachments.—For details write to BOX C551, MACHINERY, Clifton House, Euston Road, N.W.1.

Rowland Duplex Face Grinding machine. Series 6600M. two heads opposed with 24in. dia. wheels. Max. distance between 9in. Each head driven by two 40 h.p. motors. 400/3/50. Hydraulic feed pump and 2 to 3 h.p. motors, 400/3/50. Auto. feed works arm, power oscillation, hydraulic wheel dresser, control box and Allen West starter, overall size 11ft. × 8ft. × 7ft. high. This machine is ideal for facing two sides of a component with double dimensions such as a con rod, large and small end bearing facing.—BOX C577 MACHINERY, Clifton House, Euston Road, N.W.1

B.S.A. Type RA. Gridley 6-spindle Automatic. 1¼in. capacity, Universal Threading attachment, 5th position parting off slide, Late type machine with equipment. 400/3/50. Excellent condition.

ACME Type RA. Gridley, 6-spindle Automatic. 1¼in. capacity. Universal Threading on 4th and 3rd position, 5th position parting off slide, excellent condition, with considerable equipment. 400/3/50.

SNOW type T20 table, 8u face Grinding Machine. 20in. dia. wheel. Surface of table 40in. × 28in. 400/3/50.

CHURCHILL Model H.B.A. Hydraulic Internal Grinding Machine. Fitted automatic sizing. Maximum swing inside water guard. 17in. dia. variable hydraulic traverse of table 18in. 400/3/50.

BLISS 20 ton Ungeared, Open Front, Inclinable, Power Press. Adjustable Stroke ½in. to 2½in. Bed area 22in. × 13½in. 400/3/50.

H.M.E. Type C.26. Double Sided, Geared Power Press. 100 tons pressure, 5in. Stroke, Bed area 24in. × 22in. Between sides 24in. Motorised 10 h.p. 400/3/50.

New **PLANERS OF HUDDERSFIELD** 8ft. × 2ft. 6in. × 2ft. 6in. Planing Machine, 2 tool boxes on cross rail. Solenoid control. Lancashire Dynamo Drive and Control Gear. 1944 machine.

RHODES No. 3 Double Sided, Ungeared Power Press, 45 tons pressure, 2½in. Stroke, Bed area 34in. × 37in. Between sides 34in. Motorised 400/3/50.

RUSHWORTH 10ft. × ¼in. Geared, Overcrank Power Guillotine. Automatic hold-down, front and rear gauges. 400/3/50.

WEBSTER & BENNETT 48in. Vertical Boring Machine. Rapid traverse. 400/3/50.

STANCROFT LTD.,
LANCASTER STREET, BIRMINGHAM 4
ASTon Cross 2235.

Noble & Lund Fluifeed Cold Saw, Cap. 5in. dia. Rounds. A.C. Motor, etc.
Further details from:—
C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
PAISLEY.

Kearns Model O.C. Horizontal Boring Machine, 8in. dia. traversing spindle. 16 spindle speeds 18-725 r.p.m. Revolving table 42in. × 36in. Spindle to steady 7ft. 6in. Verniers. 7½ h.p. 400/3/50 motor.—LEE & HUNT, LTD., Crocus Street, Nottingham. 'Phone 84246.

F. J. Edwards Ltd

DRILLING MACHINES

CINCINNATI BICKFORD 36in. Radial Drilling Machine, spindle No. 4 M.T.

SEGIC (Swedish) 27in. Radial Drilling Machine, 1¼in. capacity, speed 80-890 r.p.m. (New.)

HERBERT Type C Pedestal Drilling Machine, No. 3 Morse Taper, 230 volts, single phase. Auto spindle feed; flange mounted motor.

LELAND GIFFORD 3-spindle Drilling Machine, mounted on 4-spindle base. Spindles No. 3 M.T., one spindle with power feed, pole change motors, 8 spindle speeds 165-1,500 r.p.m.

ARCHDALE No. 2240 28in. production type Drilling Machines, capacity in mild steel 3in. dia.

ADCOCK & SHIPLEY 28in. No. 11A Drilling Machine, 2in. capacity

ENGRAVING MACHINES

TAYLOR, TAYLOR & HOBSON Model D Engraving Machines. (New.)

TAYLOR, TAYLOR & HOBSON Model A Bench Engraving Machine. (New.)

T.M.A. Model G2 Engraving Machine, pantograph reductions 1 : 1-7 : 1.

FILING AND SAWING MACHINES

CRYPTO Horizontal Bandsawing Machine.

WELLS Horizontal Bandsawing Machine, 16in. × 5in. capacity.

GROB Model A3 Band Filing Machine, table 23in. × 17in.

RAPIDOR motorised Filing and Sawing Machine. Table 15in. × 15in.

GEAR CUTTING MACHINES

FELLOWS No. 645A3 Gear Shaper; capacity 18in. × 3in. for spurs and helical gears.

FELLOWS No. 61A and 645A Gear Cutters.

CHURCHILL-CLEVELAND Model 120 RIGID HOBBER. Capacity 6in. dia. × 9in. face, 3 d.p.

BARBER COLMAN 12in. Gear Hobber.

GENERAL LATHES

OLDFIELD & SCHOFIELD 21in. centre Gap Bed Lathe; 7ft. between centres, 4½in. hollow spindle, 62in. swing in gap.

DEAN SMITH & GRACE 12in. centre, 18ft. bed Lathe, admit 12ft. between centres; 2½in. hollow spindle; swing 44in. × 15in. in gap.

BETTS-BRIDGEFORD 30in. swing × 22ft. Lathes, 16ft. between centres.

LANG 24in. Surfacing and Boring Lathe.

COLCHESTER TRIUMPH 7in. × 6ft. 6in. Gap Bed Lathe, 4ft. between centres.

WILLSON 7½in. × 6ft. Gap Bed Lathe, 3ft. between centres.

BERRY 8½in. × 8ft. Lathe, 4ft. between centres.

SOUTHBEND 7½in. × 5ft. Lathe, 2ft. between centres.

DEAN, SMITH & GRACE 6½in. Centre, 13Z Lathe.

LANG JUNIOR 6½in. × 6ft. Lathe, 30in. between centres.

CROMWELL 3½in. × 40in. Lathe, stepless speeds to 2,000 r.p.m.

LE BLOND 10in. Rapid Production Lathe, 7ft. between centres, 1⅞in. hollow spindle, speed 45-300 r.p.m.

CAPSTAN AND TURRET LATHES

HERBERT No. 12 Combination Turret Lathe roller bearing spindle; covered vee bed swing over bed 23½in.; hollow spindle 6½in. dia.; good equipment. Chasing saddle with automatic sliding and surfacing feeds.

HERBERT No. 21 Combination Turret Lathe; swing 28in. over the bed; 7½in. hollow spindle chasing saddle with automatic sliding and surfacing feeds.

WARNER & SWASEY 3A Turret Lathe; 23½in. swing; 4½in. hollow spindle.

359-361, EUSTON RD., LONDON, N.W.1
Telephone: EUSTON 5000. Telex No. 24264.
And at Lansdowne House, 41, Water St., Birmingham, 3. *Telephone: Central 7606-8*

Classified Advertisements (*PLANT FOR SALE, contd.*)

HEILBRONN

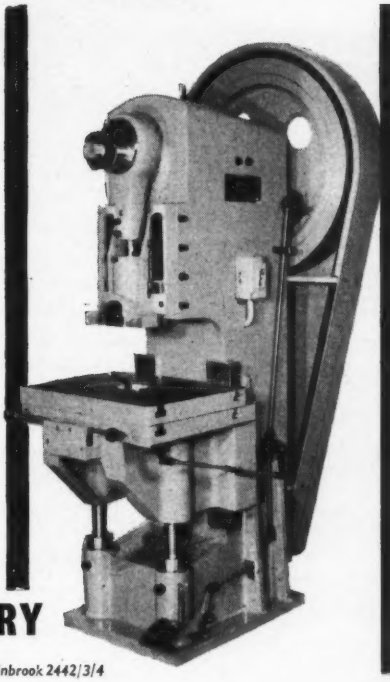
FOUNDED 1857

NEW TO THIS COUNTRY

This machine incorporates many new features including:

- Unbreakable all steel frame.
- The heavy box construction results in longer tool life.
- Ram guide ways are machine ground and finally scraped.
- The large crankshaft is of heat treated precision forged steel of high tensile strength to withstand the severest conditions.
- All machines have adjustable stroke.
- Standard machines have a rolling key type clutch fitted. If required an electro pneumatic friction clutch is available.

Early delivery can be made on 20, 30, 45 and 75 tons machines.



STEEL FRAME PRESSES

SHEET METAL MACHINERY COMPANY LIMITED

POYLE ROAD · COLNBROOK · SLOUGH · BUCKS · *Telephone: Colnbrook 2442/3/4*

Haskins High-speed Air-operated tapper, Mot. ¼in. cap., Type 3CAM. Good cond.—C. L. THOMAS LTD., Stirling Road, Solihull. 3075-6.

Disc Grinder, 30in. dia. Wheels, compound tables.—A. McNAMARA & CO., LTD., New Line, Bacup, Lancs. 'Phone: Bacup 946.

Greenwood & Batley No. 0 Solid die, single blow, Cold Heading Machine. Capacity ¼in. × 1in. long.—HICKS MACHINERY, LTD., 26, Addison Place London, W.11. Tel.: PARk 2333.

Huller Tapping Machine No. 5 Unused since complete rebuild by Burton Griffiths. £475.—PER 8476.

HERBERT No. 4B Capstan Lathe, with bar feed, 415/3/50.

DRUMMOND Model K Capstan Lathe, arranged for chucking, 415/3/50.

GISHOLT No. 4 Capstan Lathe, arranged for chucking, 415/3/50.

R. O. Gray

4/6, Minerva Road, Park Royal, London, N.W.10

Telephone: ELGar 4841/4842

Bryant No. 24-36 Hydraulic Internal Grinder complete with Hydraulic Wheel Dressing Device, Spindle, etc.

Further details from —
C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
PAISLEY.

Jones & Shipman Hydraulic Precision Universal Grinder, size 12in. × 36in. with standard equipment and internal spindle. Excellent condition.—BOX C622, MACHINERY, Clifton House, Euston Road, N.W.1.

Churchill H.B.B. Internal Grinding Machine. Fully motorised. Serial No. 21481. Can be seen running under power.—BOX C645, MACHINERY, Clifton House, Euston Road, N.W.1.

Drummond Maxicut No. 2 Multi-tool Lathe, 30in. between centres. Swing 22in., longitudinal saddle movement 18in., fitted with extra slides on front and rear toolposts. Auto. return to slides. Motorised 45 h.p. 400-440/3/50.—BOX C664, MACHINERY, Clifton House, Euston Road, N.W.1.

18in. Stroke "Brook" m/d All-gd. Cabinet type Shaping Machine with swivelling table. 4 speeds, 22-115 s.p.m.—LEE & HUNT, LTD., Crocus Street, Nottingham. 'Phone: 84246.

CLOSING DATE FOR "CLASSIFIED" ADVERTISEMENTS WEDNESDAY PRECEDING ISSUE DATE.

SOAG **DUTRANNOIT 300 TONS FRICTION SCREW PRESS**

MAIN DATA:—

Dia. of Screw Spindle	9in.
Distance between Uprights	25½in.
H.P.	17½
Length of Stroke	20in.
Max. height Ram/table	30in.

Inspection invited.

Full details from: **SOAG MACHINE TOOLS, LTD., 7, Juxon Street, Lambeth, London, S.E.11.**

'Phone: Reliance 7201. Grams: Sotoolsag, London. S.E.11

3-s.u 42

Classified Advertisements (*PLANT FOR SALE, contd.*)

Newman

AUTOMATICS

POTTER & JOHNSTON Model 5D Chucking Automatic.
BULLARD Multi-Au-Matic 7in. 8 spindle.
BULLARD Multi-Au-Matic 12in. 6 spindle.

BORING MACHINES

KEARNS No. 2 Horizontal Boring and Facing Machine, 3in. dia. travelling spindle (1953).
KEARNS No. 4 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle.
WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type PRT Horizontal Floor Boring Machine, 3½in. travelling spindle, 28in. diameter facing head.
GIDDINGS & LEWIS No. 45 Horizontal Boring Machine, 5in. diameter travelling spindle.

CAPSTAN AND CENTRE LATHES

OLDFIELD & SCHOFIELD Surfacing and Boring Lathe, 10½in. centre height.
WARD 7B Combination Turret Lathe.
HERBERT No. 12 Combination Turret Lathe, 6¼in. diameter hollow spindle.
NILES Heavy Duty Centre Lathe, 8.8. & S.C., 17in. centre height × 28ft. between centres.
U.L.R.O. Heavy Duty Centre Lathe, 16in. centre height × 30in. between centres.

DRILLING MACHINES

HETTNER Radial Drilling Machine, 10ft. elevating arm.
TOWN Radial Drilling Machine, 4ft. 6in. elevating arm. (NEW.)
TOWN 30in. Single Spindle Boring and Drilling Machine.

GEAR MACHINES

ORCUTT Model HM24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

GRINDING MACHINES

LANDIS Plain Hydraulic Cylindrical Grinding Machine, 18in. swing × 72in. between centres.
ORCUTT Model HM24 Internal Spur Gear Grinding Machines.
CHURCHILL Crankshaft Grinding Machine, 26in. swing × 84in. between centres.
CHURCHILL Plain Hydraulic Cylindrical Grinding Machine, 20in. swing × 72in. between centres.
BROWN & SHARPE Plain Cylindrical Grinding Machine, 10in. swing × 36in. between centres.
B.S.A. LANDIS Plain Cylindrical Grinding Machine, 6in. swing × 30in. between centres.

MILLING MACHINES

CINCINNATI Model 5/72 Plain Hydromatic Milling Machine, table 91in. × 22in. (1952).
CINCINNATI 1/18 Automatic Manufacturing Milling Machine.
CINCINNATI No. 2L Plain Horizontal Milling Machine, table 52in. × 10in.
CINCINNATI No. 2M Vertical Milling Machine.
CINCINNATI No. 4 Dial Type Horizontal Milling Machine.
GRAFFENSTADEN Model F1101 Plain Horizontal Milling Machine, table 52in. × 10in.
TECHNOIMPEX Universal Horizontal Mil ing Machine, table 59in. × 16in. (NEW.)
PRATT & WHITNEY Model BL3620 3-spindle "Keller" Die Sinking Machine.
CENTEC Model 3R Automatic Production Milling Machine, table 25in. × 16in.

PLANING MACHINE

SUMMERSKILL Double Column Planing Machine; capacity 16ft. × 5ft. × 5ft. Four toolboxes.

MISCELLANEOUS

RUSSEL Model 26/28 Hydrofeed Cold Sawing Machine.
LANGE & GAILEN 28in. stroke Double Headed hydraulic Shaping Machine.
TAYLOR & CHALLEN Double Sided 50-ton Geared Power Press, 10in. stroke.

NEWMAN INDUSTRIES LIMITED,
Machine Tool Division: YATE, BRISTOL

Tel.: Chipping Sodbury 3311. Telex. 44121. Cables: "Dynamo Yate."
London Office: Terminal House, Grosvenor Gardens, S.W.1. Tel.: Sloane 8206. Telex 23289.

DIMCO

No. 2 **WARNER & SWASEY** Chucking Capstan.
No. 3 **GISHOLT** Chucking Capstan, some bar feed equipment.
2D **HERBERT** Bar Beed Capstan Lathe.
2S. **HERBERT** Bar Feed Capstan Lathe.
2SS. **HERBERT** Bar Feed Capstan Lathe.
No. 7 **WARD** Bar Feed Capstan Lathe, covered bed.
4ft. **ASQUITH** Universal Drill. Portable.
6ft. × ¾in. **BENNIE** Guillotine. Heavy Duty.
8½in. **LANG** S.S. & S.C. Lathe, 4ft. between centres.
36in. × 10in. **FRITZ WERNER** Plain Miller.
New 7in. **WOODHOUSE & MITCHELL** Type 70 Junior Lathe.
60in. **JACKSON & BRADWELL** Balancing Machine.
20in. **ARCHDALE** Plain Milling Machine. Power feeds and rapids.
½in. **HERBERT** Pedestal Drill.
6in. **HOLBROOK** Toolroom Lathe.
15in. S.S. & S.C. Heavy Duty **OLDFIELD & SCHOFIELD** Lathe. Bed 12ft. 6in. Spindle speeds 65-332 r.p.m. Screwcutting speeds 1½-22 threads.
14in. **BUTLER** Slotting Machine. Circular table.
8½in. **FABIUS** Lathe, 5ft. between centres. (New.)
Model HBY **CHURCHILL** Internal Grinder.
No. 3 **KITCHEN & WADE** Vertical Honer.
No. 2 **DRUMMOND** Maxicut Gear Cutter.
27in. **WOTAN** Hydraulic Shaper.
16in. **BLANCHARD** Rotary Surface Grinder.
New **PASQUINO** Vertical Mill. Swivel head, power feeds and rapids.
New 35½in. **ZERBST** Lathe, 10ft. 4in. between centres.
New 10in. × 40in. **MIKROMAT** Hydraulic Surface Grinder.
24in. × 36in. **BULLARD** Vertical Borers.
No. 2 **WARNER & SWASEY** Chucking Capstan.
24in. × 8in. **ABRASIVE** Model 3B Surface Grinder, with magnetic chuck. As new.
New **LAGUN** 49in. × 12in. Universal Miller, with dividing heads and universal attachment. Power feeds and rapids in all directions. £1,250.

DIMCO (Gt. Britain) LTD.
28 ,Wood Lane,
SHEPHERD'S BUSH,
LONDON, W.12.
SHEpherd's Bush 4401/2.

Bliss 20 Ungeared Inclinable open fronted, 20 ton Power Press. Single pulley drive. 2in. stroke.—HICKS MACHINERY, LTD., 26, Addison Place, London, W.11. Tel.: PARk 2333.

Bryant No. 16C16 Hydraulic Internal Grinder, complete with Hydraulic Wheel Dressing Device, Spindle, etc. Further details from:—
C. & G. OLDFIELD LTD.,
15, Abercorn Street,
PAISLEY.

Several 7 kVA Sciaky Spot Welding Machines.—BOX C629, MACHINERY, Clifton House, Euston Road, N.W.1.

Taylor & Challen 60 Ton Power Press with variable stroke and roll feed.—BOX C632, MACHINERY, Clifton House, Euston Road, N.W.1.

DOUGLAS OF HIGH WYCOMBE

MACHINES FOR IMMEDIATE DELIVERY FROM HIGH WYCOMBE SHOWROOMS

MILLING MACHINES

ZBROJOVKA FA.3U Universal Mill.
AUE Hand-Lever Plain Mill.
CENTEC 2B Plain Mill.
SENIOR M.1 Plain Mill.
RUHLA Model 58 Tool and Die Mill.
BEAVER Model A Vertical Turret Mill.
VICTORIA O.2 Omnimil.
VICTORIA V.2 Vertical Mill.

DRILLING MACHINES

ARBOGA ER.825S 1in. cap. Radial Drill.
PACERA A.10 ¼in. cap. Art. Radial.

LATHES

BOXFORD AUD 4½in. S.S. & S.C. Lathe.
STANLEY 8½in. × 6ft. bet. Centre Lathe.

GRINDERS

MYFORD MG.12 Cylindrical Grinder.
JAKOBSSEN SJ.12 24in. × 10in. Hyd. Surface Grinder.
SWEDISH PLS.10 18in. × 6in. Hyd. Surface Grinder.

MISCELLANEOUS

SPEEDAX 20in. Bandsaw.
ALBA 2S 14in. Stroke Shaping Machine.
ALBA 4S 18in. Stroke Shaping Machine.
"B.E.N." VR.15 Compressor.
"B.E.N." VR.32 Compressor.

MACHINES FOR DELIVERY DURING FEBRUARY, 1961

MILLING MACHINES

BEAVER VBRP Vertical Turret Mill.
VICTORIA TV.1 Vertical Turret Mill.
VICTORIA V.3 Vertical Mill.
MARLOW Model 5 Vertical Mill.

DRILLING MACHINES

RICHMOND SR.2 48in. Arm Radial.
ARBOGA ER.1830 2ft. Arm Radial.
PROGRESS 3.E 1¼in. Pedestal Drill.
PROGRESS 4-spindle Drill.

LATHES

CARDIFF 7½in. × 60in. bet. centres Lathe.

GRINDERS

EXCEL No. 1 Surface Grinder.
ABWOOD SG.1A Hyd. Surface Grinder.
BURDETT Model 70 Hyd. Surface Grinder.

MISCELLANEOUS

VELOX 10in. cap. Hacksawing Machine.

WE ARE SOLE IMPORTERS OF THE FEINMESS RANGE OF CIRCULAR, PRECISION CIRCULAR, LINEAR AND PRECISION LINEAR DIVIDING MACHINES. FOR DETAILS OF MACHINES IN THIS RANGE PLEASE CONTACT US AT—

A. DOUGLAS CO., LTD.,
LINCOLN ROAD,
CRESSEX INDUSTRIAL ESTATE,
HIGH WYCOMBE, BUCKS.
Tel.: High Wycombe 4390 (5 lines).

Classified Advertisements (*PLANT FOR SALE, contd.*)

RING BELLS *for machine tools*

LEEDS 63-7398

MINIMUS Gear Hobber. Similar to Mikron 79. M.D. 400/3/50.

CHURCHILL H.B.A. Internal Grinder. Swings 12in. inside water guard. M.D. 400/3/50.

NORTON Type C 10in. by 48in. Hydraulic Plain Grinder. Filmatic bearings. M.D. 400/3/50.

PRECIMAX Vertical Spindle Surface Grinder. Cap. 16in. by 48in. With 18in. segmental wheel. Magnetic chuck 15in. by 48in. M.D. 400/3/50.

JONES & SHIPMAN Fig. 310 Tool and Cutter Grinder. Cap. 8in. by 16in.; using tailstock centres admits 19in. length. Working surface of table 29½in. by 4in., workhead and wheelhead swivel also elevation to wheelhead.

HUNT Model 1A Twist Drill Grinder. Cap. ¼in.-1in., main wheel 8in. by 1in; thinning wheel 4in. by ¼in. Suitable for right hand two lip drills. With 3in. three-jaw chuck various bushes and suds pump.

CARTER & WRIGHT Dual Feed Keyseater. Model No. 4. With canting head. Will cut keyways up to 30in. length by 1¼in. width. M.D. 400/3/50.

GISHOLT No. 4 Bar Feed Capstan. Swing-over hardened strip bed 18¼in. Collet cap. 2in. With draw-in collet chuck; bar feed; tooling. M.D. 400/3/50.

WILLSON 7¼in. S.S. & S.C. Gap-bed Lathes. Swings 15¾in. over V-bed and 26in. in gap. Admits 36in. between centres. M.D. 400/3/50.

CINCINNATI 3/36 Plain Hydromatic Miller. Ram type overarm. Table size 52¾in. by 14in. Speeds 8-200 r.p.m. by P.O. gears. Servo control. Single cycle.

STEDHALL Plain Miller. Table 15in. by 4¼in., power traverse 8in.

ARCHDALE 30in. Vertical Miller with Power Operated Rotary Table. Table 47in. by 14¼in. M.D. 400/3/50.

GOULD & EBERHARDT 28in. Heavy Duty Shaper. Max. stroke 30¾in. V-belt drive from 7½ h.p. Motor 400/3/50.

TOWN 4ft. Radial Drill. Model A.E.I. Spindle No. 4 M.T., 9 speeds 40-800 r.p.m. M.D. 400/3/50.

ASQUITH 4ft. 9in. Portable Universal Radial Drill. Spindle No. 4, M.T. M.D. 400/3/50.

MILLS 15-ton Hydraulic Straightening Press. With double rail straightening equipment. M.D. 400/3/50.

ABWOOD Vertical Spindle Surface Grinder. Table 18in. by 7in. Max. wheel dia. 6in. M.D. 400/3/50.

BIERNATZKI Swivel Head Vertical Miller. Model FS2A. Table 55in. by 14in. with 36in. traverse quick power all ways to table. 18 spindle speeds, 29-1,500 r.p.m. M.D. 400/3/50.

H. BELL (Machine Tools) LTD., Walter Street, LEEDS 4.

Kitchen & Wade H.4 Horizontal Drilling and Tapping Machine. Travelling Column Type with Square Indexing Table on Traversing Base.—Further details from:—

C. & G. OLDFIELD, LTD., 15, Abercorn Street, PAISLEY.

⅞in. Capacity 6-spindle B.S.A. Acme Gridley Bar Automatic. Tooling, Collets, Feeders, Drilling Spindle. Inspection London area. Delivered in 1947, reconditioned in 1955 by reputable company.—Telephone Mr. GANDER, Byfleet 43252.

1½G Reed Prentice Diecasting Machine. In excellent condition.—For further details write to BOX C623, MACHINERY, Clifton House, Euston Road, N.W.1.

Swift Sentinel Lathe. Type 10SP 20in. swing × 6ft. between centres. Excellent condition.—BOX C673, MACHINERY, Clifton House, Euston Road, N.W.1.

SOAG

Crank Pin Turning Machine

Mfr. RICHARDS— Singe Head Type with rotating cutter head and stationary crank shaft.

Main dimensions:—

Slide travel	12in.
Dia. revolv. disc	24in.
Work table	4 ft. 10in. by 3ft. 6in.
Main motor	35 H.P.
Feed motor	6½ H.P.

Inspection invited.

Full details from:—

SOAG MACHINE TOOLS, LTD., 7, Juxon Street, Lambeth, London, S.E.11.

HIGH QUALITY USED MACHINE TOOLS

COVMAC 13in. Swing Gap Bed Lathe, by 3ft. 3in. b.c. 400/3/50.
COVMAC 17in. Swing Gap Bed Lathe, by 5ft. 0in. b.c. 400/3/50.
DENHAM 6in. Gap Bed Lathe by 2ft. 3in. b.c. 400/3/50.
GRANOR OF HALIFAX 18in. × 28ft. b.c. A.G.H. Gap Bed S.S. & S.C. Lathe. 400/3/50.
D.S. & G. 7in. CH by 4ft. 0in. b.c. Straight Bed Lathe. 400/3/50.
BARDONS & OLIVER No. 3 Universal Turret Lathe. 400/3/50.
GISHOLT No. 5 Universal Turret Lathe. 400/3/50.
WARNER & SWASEY 1A Turret Lathe. 400/3/50.
KELLY 28in. Stroke Heavy Duty Shaping Machine with swivelling table. 400/3/50.
RUSSELL Saw Sharpening Machine, max. capacity 42in. diameter. 400/3/50.
BUTLER 8in. Precision Slotter. 400/3/50.
ORMEROD 12in. Slotting Machine. 400/3/50

WE UNDERTAKE REBUILDING OF ALL TYPES OF MACHINE TOOLS

CENTAUR TOOL WORKS,
EYRE STREET, SPRING HILL, BIRMINGHAM, 18

Tel. EDGbaston 1118 & 1119 'Grams Capstan, Birmingham

Huller UG3 Pedestal Tapper. ¼in. cap. in steel. Controlled pitch. 3 speeds. Mot.—WILCOX & CO., Barr Street, Birmingham 19. NORthern 1234/5.

Toledo No. 5A Geared Inclinable Power Press for sale. Exceptionally large daylight of 14in. Pressure exerted about 40 tons. Stroke 4in. Bed 27in. × 19in. Detachable front tie bars. "Udal" automatic safety guard. Arranged motor drive, 400/3/50.—F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham, 3.

No. 3 "Van Norman" M/D. All-geared Plain Milling M/c. Table 64in. × 14in.; long. traverse 32in. 18 feeds ¼in.-20in. per minute. Rapid power traverse.—LEE & HUNT, LTD., Crocus Street, Nottingham. Tel.: 84246.

EDWIN MILLEN & SONS LTD.

70, CLERKENWELL ROAD, LONDON, E.C.1.

Tel.: CLE. 6064 & 3602.

DRILLING AND TAPPING

HERBERT 1-sp. Drill on three-spindle base. £165.
HAGO H.G.25 High Efficiency, ¾in. cap. £250.
THIEL ¾in. Radial Arm Tapper. £150.

GRINDERS

NORTON Uni. Hyd. Cyl. 48in. × 13in.
ABWOOD Vert. Sp. Surface, 18in. × 6in. £225.
NORTON 18in. × 7in. Hyd. Cyl. Grinder. £395.

LATHES

COLCHESTER STUDENT 6in. × 24in. Full equip.
WILLSON 7¼in. × 36in. G.B. Full equip.
SMART & BROWN Model M. Full equip.
HARRISON 44in. × 42in. G.B. Full equip.
LITTLEJOHN 5in. × 24in. on Cab. Full equip.
MYFORD SUPER 7. As new.
MORINI & BOSSI 1¼in. bar feed and tooling.
MURAD 2C 1¾in. cap. As new.
EMPIRE 7in. × 42in. T/T. Full equip.
LANG 42in. Swing FB Lathe.
HOGARTH 6in. × 32in. S. & S. Lathe. £125.
PITTLER Turret Lathe, 2¼in. cap. £95.
RIVET Instrument Lathe, 4¼in. × 24in.
SPRINGFIELD 34in. Swing F. & B. Lathe. £450.
SPRINGFIELD 14in. Swing F. & B. Lathe. £225.

MILLERS (Vert. and Horiz.)

CINCINNATI No. 2 Vert. Dial type. £850.
ARCHDALE 52in. × 14in. Vert. £475.
CENTEC No. 2 on Cab. As new. £125.
HENRY MILNES Vert. 30in. × 8in. As new.
ADCOCK & SHIPLEY 1VM Vert. 25in. × 7in. As new.
CINCINNATI No. 0-8 Vert., 24 × 9. £275.
HARDINGE 24in. × 6in. Prec. Auto feed. £165.

POWER PRESSES AND SHEET METAL MACHINES

COHEN 10 ton Friction Screw Press.
E.M.G. 9-ton Airdraulic. £200.
KENNEDY 2in. Tube Bender. £85.
FLY and Kick Presses.

MISCELLANEOUS

ORMEROD 12in. Shaper with Cam Cutting Attach.
TMA Engraver with type.
AEROGRAPH Twin Cylinder comp. 100 p.s.i.
MATHEY Jig Borer with clocks. As new.
RAPIDOR 15in. × 15in. Filing and Sawing. £165.
BUTLER 12in. Precision Slotter. £675.
PFAUTER 000 Gear Hobber, with gears. £150.
PHILLIPS 40 kVA Spot Welder. £165.
CHARLES TAYLOR 6½in. Spinning Lathe. £85.

Other machines in stock.

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WE SELL **HIRE PURCHASE ARRANGED**

Classified Advertisements (*PLANT FOR SALE, contd.*)

GATE

OFFER THE FOLLOWING MACHINES

BORERS AND DRILLS

VOA Jig Borer, 20in. × 15in. Table Movement.
BUTLER 4ft. Double Column Vertical Borer, motor drive, speeds to 44 r.p.m.
SELLARS 5in. Horizontal Boring Machine, cross traverse of table 60in.

GRINDERS

NOVAMATIC "A" Internal Grinder.
LANDIS Plain Cylindrical Grinder, 6in. × 18in.
HORSTMAN Thread Grinder, capacity 5in. dia. × 9in. b.c.

LATHES, CAPSTANS AND AUTOMATICS

BROADBENT 12½in. Centre × 72in. b.c., swings 42in., 4¼in. hollow spindle, speeds 11-375, 12½ h.p. motor. Timken roller bearing headstock.
HERBERT No. 20 Comb., spindle bore 7in., speeds 5-201.
WILSON 7½in. Centre Lathe.
ROLLO 6½in. Centre Lathe.
Two **CLEVELAND** ⅞in. Model A Single Spindle Autos.
BOYES & EMMS S.S. & S.C. Lathe, centre height 16in. × 7ft. 6in.
HERBERT No. 9 Combination Turret Lathe.
SWIFT Hydraulic Copying Lathe, 36in. swing × 5ft. 6in. b.c., 30 h.p. drive.

MILLERS

ARCHDALE 28ip. Horizontal Miller.
VICTORIA UI Universal Miller, with vertical attachment.
BROWN & SHARPE No. 2 Vertical Mill, table 54in. × 14in., speeds 30-1,200 r.p.m. Power down feed to head.
HURTH Single Head Keyseater, table 26in. × 9in.
SCHIESS DEFRIES Vertical Keyseater.

PRESSES

30 ton **RASKIN** Double Sided Double Geared Drawing Press. Area 20in. × 23in. Draw 4½in.

SLOTTERS, SHAPERS AND PLANERS

NEWEY 14in. Shaper.
MAXICUT High Speed Gear Shaper, max. dia. 7in. × 2in. face.
NEW **POREBA** Model HDA80 Planer, capacity 10ft. × 32in. × 30in. table, drive by Heid gearbox.

MISCELLANEOUS

MORGAN 4ft. × ¼ Overcrank Guillotine.
CIRCULAR Graduating Machine for English, metric and degree graduations.

Visitors always welcome

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Churchill 12in. × 36in. Universal Grinder. Hydraulic Stroke. Internal Attachment. Complete Machine. Full details from:—
C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
PAISLEY.

Norton Universal Grinding Machine. 1942. Size 12in. × 36in. Condition good. External/internal equipment.—BOX C679, MACHINERY, Clifton House, Euston Road, N.W.1.

MARTIN
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EMPRESS WORKS, EMPRESS STREET
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USED MACHINES IN STOCK AVAILABLE FOR IMMEDIATE DELIVERY

RICHARDS 48in. Vertical Borer.
KEARNS No. 2 Horizontal Borer, travelling spindle.
AMERICAN TOOLWORKS 4ft. Radial Drill.
CORONA Single Spindle Drill, No. 2 M.T.
POLLARD 4 Spindle Drill, No. 3 M.T.
HERBERT No. 7 Combination Turret Lathe.
GISHOLT 1.L Combination Turret Lathe.
WARD 3A Capstan Lathe.
WARD 7 Capstan Lathe.
CHURCHILL HCY Internal Grinder.
CHURCHILL No. O 6in. × 18in. Universal Grinder.
STANLEY 8½in. × 48in. S.S. & S.C. Lathe.
CHURCHILL REDMAN 13 N.M. × 7ft. 6in. S.S. Lathe.
ARCHDALE 18in. Vertical Miller.
MODERN Horizontal Miller, 9in. × 40in. (Overhauled).
STANCO 5ft. × ½in. deep throat Guillotine.
RACCINE 6in. cap. Hacksaw.
PRATT & WHITNEY Thread Miller, 4½in. × 12in.

NEW MACHINES IN STOCK OR ON SHORT DELIVERY

H.M.V. Horizontal Borer, type A.V.75 Travelling Spindle and Facing Head.
KERRY Super 8 Bench Drill.
FOBCO ½in. capacity Bench Drill.
SPEEDAX Abrasive Cutting-Off Machine.
QUALTERS & SMITH 6in. Hacksawing Machine.
BEAVER "VBRP" Turret Miller.
RAPIDOR Medium Duty 6in Saw.
WORCESTER 6 ton Crank Press.
UNION TOOL & CUTTER Grinder.
DENBIGH No. 6 Fly Presses.

MACHINE TOOLS AVAILABLE FOR SALE BUT NOT IN STOCK

PEGARD Kneeless Type Vertical Miller, under Spindle, Table travel app. 4ft.
KEARNS Patent No. 2 High Speed Surfacing, Boring and Milling Machine, New 1959.
BUFFALO 28U Double Ended Punch, Shear and Angle Cropper.
STIRK Vertical Boring and Turning Miller. 6ft. 1in. swing.
L.M.B. Boring and Turning Miller, 5ft. swing.
ASQUITH 6ft. Radial Drill with screw cutting attachment.

MACHINES MOTORISED 400/3/50 UNLESS OTHERWISE STATED

The above list is only a selection of the many new,used and rebuilt tools available;. please call or write for our priced brochure We will rebuild your own machine tools back to makers' specification with six months' guarantee.

Harry Kirk

can recommend the following modern quality machines from STOCK

AUTOMATICS

BULLARD 8in. Mult-au-Matic, 6 spindles type D.
RYDER Verticalauto, capacity 16in. swing × 8in., 6 spindles.

BORING MACHINES

RICHARDS 36in. Vertical Boring Mill complete with side head.
JONES 6in. Spindle Horizontal Borer. Table 17ft. 6in. × 8ft. Spindle travel 48in. Rapid traverse 84in. per min. Motorised 400/3/50. Weight 70 tons.
SCHARMANN 3in. Sliding Spindle Horizontal Boring Machine, equipped with facing head and screwcutting.
BULLARD 36in. Vertical Boring Mill.
KITCHEN & WADE Vertical Fine Boring Machine, 14in. stroke. Compound table.
SCHIESS Vertical Boring Mill, 39in. dia. of table. Maximum swing 48in. S.C.M.D. 35 h.p., 400/3/50.

GRINDING MACHINES

HEALD No. 172 Gap Bed Internal Grinding Machine, maximum diameter of component 36in.
BILLETER Hydraulic Open-side Slideway Grinding Machine, capacity 47in. × 12in.

LATHES

NOBLE & LUND Heavy Duty Centre Lathe. 22in. centre height × 29ft. between centres. Max. swing over saddle 33in. dia.
HARVEY Heavy Duty Centre Lathe, 42½in. centre height × 52ft. between centres. Max. swing over saddles 65in. dia.
CHURCHILL-REDMAN S.S. & S.C. Centre Lathe, 7½in. centre height × 4ft. 6in. between centres.
DENHAM S.S. & S.C. Gap Bed Centre Lathe, 15½in. centre height × 12ft. 6in. between centres. Swing 54in. in gap, complete with Taper Turning Attachment. Faceplate, Chucks, etc.
CRAVEN S.S. & S.C. Centre Lathe, 13½in. centre height × 65ft. between centres.
CRAVEN S.S. & S.C. Centre Lathe, 13½in. centre height × 31ft. 6in. between centres.
WERMELINGER Centre Lathe. Model MJ8. 6in. centre height × 32in. between centres.
HERBERT No. 11 Combination Turret Lathe.

MILLING MACHINES

BROWN & SHARPE No. 3 Vertical Milling Machine.
ARCHDALE 30in. Vertical Milling Machine.
COLLET & ENGLEHARDT Keller Type Die Sinking Machine. Model FKf 80, capacity 60in. × 30in.

PLANING MACHINES

ORMEROD 24in. Heavy Duty Shaping Machine.
CLEVELAND Openside Planing Machine, capacity 10ft. × 2ft. 6in.
CINCINNATI Planing Machine, capacity 8ft. × 2ft. 6in.

MISCELLANEOUS MACHINES

BUTLER 18in. Stroke Slotting Machine.
SUNDERLAND No. 11 Gear Planer. Max. capacity 74in. dia. Max. stroke 9in. face. S.C.M.D. 400-440/3/50.
CLIFTON & BAIRD Cold Circular Saw.
Hydraulic Vertical Internal Honing Machine (manufactured by **PETER WOLTERS**). Capacity 0.2in. to 2in.
RAPIDAN Double Helical Gear Generating Machine, 12in. diameter capacity.

Further detai's from

HARRY KIRK ENGINEERING LTD.,
BRANDON ROAD WORKS, BRANDON ROAD, COVENTRY

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SERVICE EDWARDS VALUE

RHODES Super Shear Power Guillotine. Open ended overcrank type. Motorised for 400-440/3/50 supply. Capacity mild steel 7ft. × 14 S.W.G. Fitted with automatic hold-down, finger guard and adjustable front, back and side gauges. Weight approx. 60 cwt.

BUFFALO FORGE Horizontal Section Rolling Machine. Motorised for 220-440/3/50 supply. Capacity angles leg out 2in. × 2in. × ¼in. Angles leg in 1¼in. × 1¼in. × ¼in. Flats on edge 2in. × ¼in. Flats on flat 5in. × ¼in. Rolling speed 40ft. per minute. Weight approx. 30 cwt.

BRADLEY & CRAVEN Geared Press Brake. Motorised for 400-440/3/50 supply. Max. pressure approx. 65 tons. Forming capacity 10ft. × 12 S.W.G. over die opening of ¼in., or 8 ft. × ¼in. over die opening of 1¼in. Between frames 101¾in. Weight approx. 8½ tons.

CRAIG & DONALD Deep Gap Guillotine Shearing Machine. Motorised for 440/3/50 supply. With automatic hold-down and adjustable back gauge. Capacity 14ft. × ¼in. Complete with three spare sets of blades. Weight approx. 11 tons.

FOUR BLACKBURN & CRAWSHAW Rotary Shearing Machines. Motorised for 400/3/50 supply. Fitted with adjustable gauge. Capacity ¼in. thickness. Cutters 5¼in. diameter × ¾in. thickness. Cutting speed 5ft. 6in. per minute. Weight approx. 10½ cwt.

RHODES Motorised Double Geared Press Brake. With cast iron side frames, reinforced by nickel-chrome steel bars. Bed and top beam of steel plate. Direct geared motor drive for 400/3/50. Pressure exerted approx. 150 tons. Forming capacity 10ft. × ¼in.; or 18ft. × approx. ¼in. Clear width between housings 10ft. 2in. Weight approx. 20 tons.

TAYLOR & CHALLEN Double Sided Double Action Cam Action Drawing Press. Can be supplied motorised for 400-440/3/50 supply. Punch stroke 8in. Blankholder stroke 4in. Between uprights 20in. Bed 18in. × 15½in. Hole in bed 8in. diameter. Weight approx. 45 cwt.

Photographs of the above are available.

VERY FAVOURABLE HIRE PURCHASE TERMS CAN BE OBTAINED.

MACHINE TOOLS, NEW AND USED, Of Every Description. Attractive Prices.

F. J. EDWARDS LTD.,

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Telephone: EUSton 5000 Telex. No. 24264

And at Lansdowne House, 41, Water St., Birmingham 3. *Telephone: Central 7606-8*

Norton Angle Head Cylindrical Grinding Machine. Size 10 × 36. Motorised 440-350.—BOX C626, MACHINERY, Clifton House, Euston Road, N.W.1.

Acme-Gridley 6-spindle Chucking Automatic Lathe. Model RUC6. Series 42000. Full details apply BOX C608, MACHINERY, Clifton House, Euston Road, N.W.1.

HARVEY (S.M.T.C.) Heavy Duty Lathe, S.S. & S.C. 18in. centres by 9ft. 6in. b.c. 29in. swing over saddle. Ball and Roller bearing spindle, 12 speeds 8·6/225 r.p.m. Rapid traverse to saddle. 32in. chuck. 15 H.P. motor 400/3/50. £2,250.
BOX C.599, MACHINERY, Clifton House, Euston Road, N.W.1.

ACBARS LIMITED,

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Telephone: Central 2287 Telegrams: Acfirb Cent. London

AVAILABLE FROM STOCK

All machines listed below are at our Works in Sutherland Walk, Walworth Road, S.E.17

BORER

New GRAFFENSTADEN AF075 Horizontal Borer. 3in. spindle. 17¾in. faceplate.

BROACH

FORST RIA5 Universal Vertical Broach for internal and surface broaching, 5 tons, 39¾in. stroke. 1952 machine.

RADIAL DRILLS

New VOEST Swivel Head Radial, 1in. capacity, 3ft. 3in. radius.
CERUTI Type TNC60 5ft. 8in. Heavy Duty Radial. 1952 machine.

GRINDERS

BROWN & SHARPE No. 2 Surface.
GRAND RAPIDS 18in. × 6in. and 24in. × 10in. Hydraulic Surface Grinders.
MOPCO 39in. × 11in. Hydraulic Surface Grinder, with inclinable spindle for horizontal or vertical grinding.
CHURCHILL 10in. × 24in. Universal.
LANDIS 12 × 48 Universal.
BROWN & SHARPE No. 3 Universal.
NORTON 14in. × 36in. Universal.
ROWLAND Three Wheel Carbide Tool Grinder and Lapper.
NEWALL 10U Universal Lapper.

CAPSTAN AND TURRET LATHES

MOREY 2G, 1in. collet capacity.
GISHOLT IL Turret Lathe.
FOSTER No. 2B Turret Lathe.

CENTRE LATHES

WARD, HAGGAS & SMITH 8¼in. Gap Bed, 36in. between centres.
CROMWELL 3¼in. Precision.

MILLERS

KENT OWENS 1-8 Horz. Hydraulic.
SUNDSTRAND No. 0 Rigidmill.
ARCHDALE 14in. Horizontal.
New GRAFFENSTADEN FU073 Universal, table 49¾in. × 10¾in.
GRAFFENSTADEN FH121 Plain Horizontal with Universal Vertical Head. Table size 59in. × 13¾in.
REIDEN No. 2 Vertical. 1953 machine. Table 49½in. × 14in., 29½in. traverse.
HERBERT 23V Vert. Table 68in. × 17in. 48in. traverse.
REED PRENTICE No. 6 Heavy Duty Vert. Table 84in. × 20in. 72in. traverse.
HOLROYD T117 Thread Miller.
HELLER Automatic Thread Millers (4).
MOREY 12M Duplex Profiler.
ASQUITH HKO Duplex Keyseater.

PRESS

V & O No. 11 Double Action. Approx. 10 tons. Roll feed. Max. draw 1in.

All machines motorised 400/3/50 unless otherwise stated

No. 3 Drummond-Maxicut Automatic Gear Shaper. Capacity 18in. dia. × 5in. feed. 4/5 D.P.—LEE & HUNT, LTD., Crocus Street, Nottingham. 'Phone: 84246.

CONOMATIC 6 spindle 1¼in. capacity post-war Machine, condition excellent.
WARD 7 Capstan, covered bed, bar and chuck machine, only worked 200 hours.
ASQUITH 5in. Foor Borer.

FRYE MACHINE TOOL CO. LTD.,
POYLE ROAD, COLNBROOK, BUCKS.
Telephone: Colnbrook 2442.

Rhodes No. 22 Bar Shearing Machine for sale. Similar to a double sided press. Capacity 250 tons. Shears mild steel plates 17in. wide × 1¼in. thick. Arranged motor drive 400/3/50. Width between guides 25¼in. Stroke 5¼in. Weight about 13¼ tons. Photo: F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham, 3.

Town Radial Drill, Type A.E.O. 42in. arm, elevating table, saddle mounted motor, low base, No. 3 M.Y. Ex. Cond. Modern M/c.—C. L. THOMAS LTD., Stirling Road, Solihull. 3075-6.

C.M.C. S.S. & S.C. Lathe, Swing 28in. dia. over bed, 8ft. between centres, 400/3/50. £575.—A. McNAMARA & CO., LTD., New Line, Bacup, Lancs. 'Phone: Bacup 946.

Gisholt No. 5 Capstan Lathe, 2¼in. bar capacity.
Complete with Bar Feed Unit Splash Trays. All electric 3-jaw chuck. Four-way toolpost. Full set of Collet Pads and some Turret Tooling. Can be seen working:— Price £400.
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Tel.: Brookwood 2036.

Conomatic 8-spindle 1¼in. Capacity Auto. Excellent condition and well equipped, including Screwing, Spindle, High Speed Drilling attachments, Collets, Feeders, Stock Reel and Stand. Inspection by appointment.—Apply to BOX C548, MACHINERY, Clifton House, Euston Road, N.W.1.

Corona Heavy Duty Vertical Drilling Machine. No. 5 Morse Taper Excellent condition.
Further details from:—
C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
PAISLEY.

CINCINNATI 6in. × 26in. Plain Cylindrical Grinder, with Filmatic Bearings, variable hydraulic table traverse, plunge cut grinding, 415/3/50.
MATRIX No. 10 Thread Grinder, 12in. × 14in., 415/3/50, with crushing attachment.
CHURCHILL Model "O" Universal Tool and Cutter Grinder, 415/3/50.

R. O. Gray.

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Churchill 10in. × 24in. Universal Grinding Machine (1944). With steadies, etc.—BOX C549, MACHINERY, Clifton House, Euston Road, N.W.1.

Landis 12in. × 36in. External/ Internal Grinding Machine with Excello Internal Spindle. Chucks and Steadies. Good condition. If interested telephone Mr. GANDER, Byfleet 43252.

American Toolworks Centre Lathe, 19in. Swing, 30in. between Centres. Spindle speeds 17-600 r.p.m. Excellent condition.

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NEWALL
USED MACHINE DIVISION

HAVE AVAILABLE FOR EARLY DELIVERY

One NEWALL 2436 Jig Borer, fully rebuilt and carrying maker's guarantees.

One NEWALL No. 0 Jig Borer, fully rebuilt and carrying maker's guarantees.

Capacity: 18in. by 12in. Table 14in. Spindle Nose to top of table

One NEWALL 'L1' Internal Grinding Machine, 10in. by 24in. fully rebuilt and carrying maker's guarantees. Maximum Grinding Depth: 12in.

One NEWALL No. 1 Jig Borer, fully rebuilt and carrying maker's guarantees.

One NEWALL No. 2 Jig Borer, fully rebuilt and carrying maker's guarantees.

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EDWARDS 8ft. × ¼in. Heavy Duty Hand Geared Folding Machine.
SEDGWICKS type C.10 Q.L. 10ft. × ¼in. Universal Bending and Folding Machine. Motorised 415 volts, 3 phase, 50 cycles, with control gear.
EDWARDS 4ft. × 14g. Power Guillotine, 415 volts, 3 phase, 50 cycles.

R. O. Gray

4/6, Minerva Road, Park Royal,
London, N.W.10
Telephone: ELGar 4841/4842

AUTOS
CONOMATIC 1¼in. 8 spindle. Type W.W.
BORING
KEARNS No. 2 Boring and Facing.
DRILLING
ASQUITH 4ft. 6in. O.D.1 Radial Drill.
PROGRESS 5E. Round table.
GRINDING
LANDIS 12 × 48 Universal Grinder.
CHURCHILL 8 × 36in. Plain. Hydrauto bearings.
LATHES
WARNER & SWASEY No 2A Long bed.
SOUTHBEND 16in.
EDGWICK 7in.
DEAN, SMITH & GRACE. Height of centres 7in.
WARNER & SWASEY No. 5 Preselector.
MILLING
20in. ARCHDALE Plain Mill. Rapid.
18in. EDGWICK Production Mill
MILWAUKEE 2E Plain.
SHAPING
24in. CHURCHILL REDMAN Heavy Duty.
19in. TOWN Heavy Duty.
SHEET METAL
GUILLOTINES
EDWARDS 6ft. × ¼in. Overcrank.
EDWARDS 8ft. × ¼in. Overcrank.
FOLDERS
MORGAN 6ft. × 14g. Universal.
EDWARDS 6ft. × ¼in. Swing beam, hand geared.
EDWARDS 6ft. × 14g. Open ended.
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6ft. × 12g. between column. Delivery 10 weeks.
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All machines motorised 400/3/50 cycles.

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Telephone: Coventry 88072/3.

Thompson & Munroe Single Wire Automatic Straightening and Cutting-Off Machine for sale. Capacity from 18 S.W.G. to 11 S.W.G. Cuts off any length up to 18ft. Spinner type straightener. Motor drive, 400-440/3/50.—F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham, 3.

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Wickman Erodosharp Spark Erosion Machine with Dust Extractor, as new.—A. McNAMARA & CO., LTD., New Line, Bacup, Lancs. 'Phone: Bacup 946.

Newall No. 0 Jig Boring Ma- chine, in very good condition. Inspection by appointment. 400/3/50. £1,100.—HIGH SPEED SERVICE TOOL CO., LTD., Elmbridge 1135.

Lang Heavy Duty Boring and Facing Lathe, 14in. swing × 54in. between centres. Speeds 19 to 900 r.p.m. Feeds 36 to 432 c.p.i. Hole in spindle 1¼in. dia. £200 ex works. O.N.O. London area.—BOX C575, MACHINERY, Clifton House, Euston Road, N.W.1.

Automatic. Peterman 7 mm. capacity, complete with four tool slides, screwing attachments, excellent condition. motor drive, 400-440/3/50. Seen London area. —Telephone: Prospect 8237, or write BOX C505, MACHINERY, Clifton House, Euston Road, N.W.1.

FOR SALE

HERBERT No. 7 JUNIOR Combination Turret Lathe; bar capacity, 2¼in.; Flamard covered bed; height of centres, 8¼in.; hexagon turret with 2¼in. dia. holes; power feed to turret; power cross and longitudinal feed to saddle; arranged for screw-cutting; 8 rates spindle speed, 30 to 750 r.p.m.; complete with overhead pilot bar, dead length collet chuck and bar feed, 18 sets collet pads, four-way toolpost, rear toolpost, taper turning attachment, 3 leaders and nuts, 6 plain toolholders, 2 knee turning toolholders, suds pump and piping; 400/3/50 motor drive.

Excellent condition.

L. E. H. COOK LTD.
Mountgrove Road,
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We Lead the Way, Others Follow
CINCINNATI No. 2MH. Plain Horizontal Miller. Table 52¾in. × 10¼in.
BARDONS & OLIVER Turret Lathe No. 3. Universal & Plain. 2in. Bar cap.
ABRASIVE 3B Horizontal Spindle Surface Grinder. 24in. × 8in.
KITCHEN & WADE 8ft. Girder Radial Drill No. 5 MT.

NORMAN E. POTTS
(MACHINERY) LTD.,
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Birmingham, 12.
Tel.: VIC 1278.

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TOO LATE FOR
CLASSIFICATION
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Classified Advertisements (*PLANT FOR SALE, contd.*)

QUALITY MACHINE TOOLS for

BORING-MILLING & TURNING IN STOCK

HORIZONTAL BORERS

KEARNS "S" Type Horiz. Boring Machine, chuck type, motor drive, table size 16in. by 22in. Late type, well equipped, new condition.

GILLY AFM F65, 2¼in. spindle, table type, MT No. 4, with continuous automatic facing head, built in rotating table, verniers, screw-cutting, table 35½in. by 28in., distance spindle to outer stay 71in., 18 spindle speeds from 10-1,250 r.p.m., facing capacity 19¾in. H.P. motor 7½in., late type.

HARVEY (Scottish M/c. Tool Corp.) 3in., floor type, with travelling spindle, rise and fall head-stock, travelling column, vertical travel 65in., horizontal travel 8ft., 18 spindle speeds from 20 to 700 r.p.m. H.P. spindle motor 4. Complete with floor plates.

RICHARDS PRTN3, 3½in. spindle, cont. aut. facing head, covered bed-ways, main table 60in. by 36in., quartering table 42in. by 42in., distance spindle nose to outer stay 108in., vertical travel 36in.

KEARNS No. 4 Patent Type with oversize spindle 4½in. dia., continuous automatic facing head covered both ways. Table (main) 66in. by 42in. Max. distance nose to outer stay 93in. H.P. motor 15.

VERTICAL BORING MILLS
DOUBLE COLUMN TYPES

3ft. RICHARDS 2 T.H. on crossrail, table dia. 2ft. 10in., 12 table speeds, 2.5-60 r.p.m., h.p. table motor 15.

7ft. 3in. RICHARDS, 2 T.H. on crossrail, table dia. 6ft. 6in., 12 table speeds 1.19-24 r.p.m., h.p. table motor 20.

8ft. STIRK, 2 T.H. on crossrail, table speeds 0.5-26.44 r.p.m. table dia. 7ft. 3in.

SINGLE COLUMN TYPES

BULLARD 36in., spiral drive with side head table dia. 34in., h.p. motor 39.

SCHIESS 13 EK 105-40in.—max. turret head on crossrail, sidehead with square tool holder. Max. swing 41in. Speed range 9-155 r.p.m. H.P. motor 35. 1952 machine.

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SONDERMAN & STEIR 40in. table Vertical Boring Machine. Swing 42in. Table speeds to 135 r.p.m. M/D 400/3/50.

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Offers to be made in writing to the Engineer and Surveyor in envelope endorsed "Lathe," not later than 10th March, 1961.

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Classified Advertisements (*SITUATIONS VACANT, contd.*)

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Kent Alloys Ltd., of Temple Manor Works, Strood, Kent, require a fully experienced Planning, Estimating, and Rate Fixing Engineer. Good salary and working conditions, contributory Pension Scheme and Employees Share-holding Scheme operated. Travelling expenses paid if selected for interview.—Apply, giving full details of age, experience, etc., to: Personnel Manager.

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High Level Position

Opportunity occurs for a Purchasing Sales Executive in our used Mechanical Handling Division. Man capable of purchasing, advertising, selling, with original ideas, etc. Knowledge of forklift truck sales essential. Must be keen, with the right type of enthusiasm and adaptability. Salary of £1,250 per annum. Modern car supplied. Apply Managing Director, Mathew Brothers, Matbro House, Beddington Lane, Croydon, Surrey. Tel.: THOrnton Heath 3402/3/4.

A Branch of the Matbro Organisation.

Foreman with First Class Engi- neering experience for small machine tool assembly department. Wages enable earnings up to about £25 per week.—Please apply in writing to TECHNICAL & WORKS MANAGER, W. J. MEDDINGS LTD., Ipswich Road, Trading Estate, Slough, Bucks.

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Foreman, Working, Required for small progressive specialist production engineers, 15 miles south of Birmingham, employing 20 people.

Must be good disciplinarian, tactful, and have first rate knowledge of single spindle automatics, and Landis dieheads. Position carries good rate, staff status, and is pensionable.

Write, stating age, full experience, present salary, etc.—BOX C642, MACHINERY, Clifton House, Euston Road, N.W.1.

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LIGHT ENGINEERING INSTRUCTOR required for September, 1961, or earlier. Applicants should possess O.N.C. or C. & G. Cert. (Mechanical Engineering) or equivalent, with good experience in industry.

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Premises are being extended to accommodate 35 students with considerable development of the Light Engineering workshop. The successful applicant must therefore be available for consultation with the present Instructor during the summer term.

The Instructor can be resident or non-resident, but resident duties are required in either case. Salary on scale according to qualifications and experience with appropriate Superannuation and full emoluments if resident.

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Principal.

8th February, 1961.

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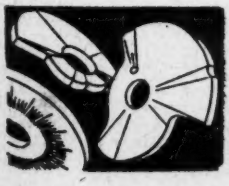

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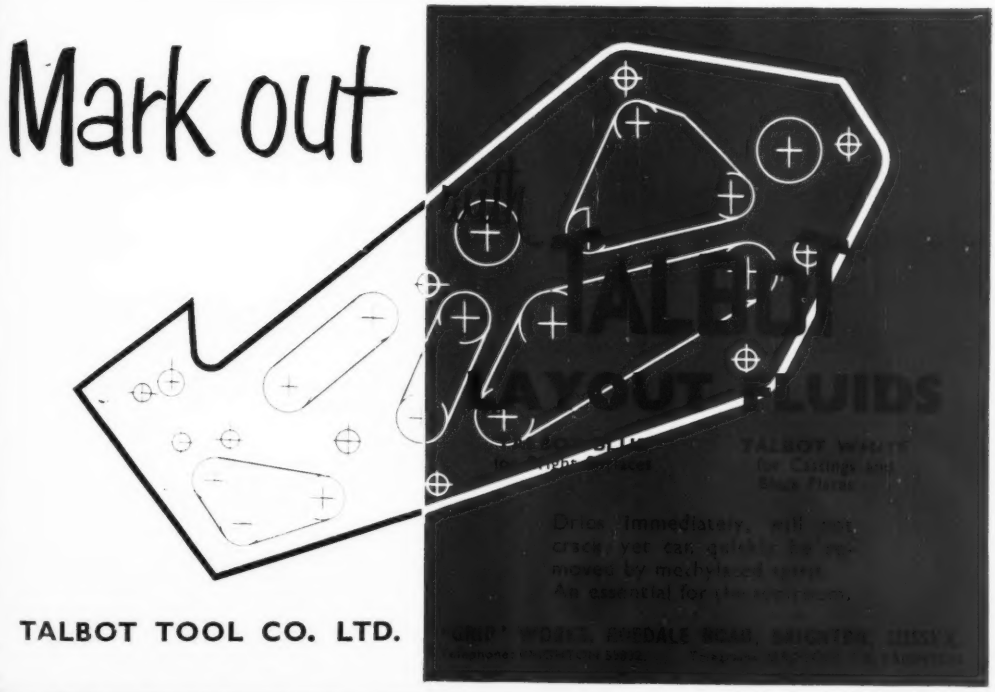
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